



**Factors predicting work status three months after injury:
results from the Prospective Outcome of Injury Study**

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3 **Factors predicting work status three months after injury: results from the Prospective Outcome of**
4
5 **Injury Study**
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ABSTRACT

Objective: Few studies examine predictors of work status following injury beyond injuries presenting to a hospital or emergency department. This paper examines the combined influences of socio-demographic, occupational, injury, and pre-existing health and lifestyle factors as predictors of work status three months after hospitalised and non-hospitalised injury in a cohort of injured New Zealand workers.

Methods: Workforce active participants (n=2626) were identified from the Prospective Outcomes of Injury Study, a cohort study of injured people registered with New Zealand's national no-fault insurance agency. Seven dimensions were considered: six pre-injury dimensions (socio-demographic, physical work, psychosocial, work organisation, lifestyle, health) plus an injury-related dimension. The outcome of interest was 'not working' at the time of interview. Multivariable logistic regression models were built for each of the seven dimensions and an overall multi-dimensional model.

Results: 720 (27%) reported 'not working' three months after injury. Multidimensional modelling found the most important pre-injury predictors of not working following injury were: low or unknown income, financial insecurity, physical work tasks, temporary employment, long-week schedules, obesity, perceived threat to life and hospital admission. Contrary to expectations, workers reporting less frequent exercise pre-injury had lower odds of work absence. Pre-injury psychosocial and health factors were not associated with not working.

Conclusion: Certain pre-injury socio-demographic, physical work, work organisation, lifestyle and injury-related factors were associated with not working three months after injury. If these findings are confirmed, intervention strategies aimed at improving return to work should address multiple dimensions of both the worker and workplace.

BACKGROUND

A timely and sustainable return to work is a crucial rehabilitation outcome for workers following injury, as prolonged work absences result in significant personal and societal costs.^{1 2} Many studies investigating factors associated with work status following injury are restricted to particular injury types or body regions.³⁻⁶ Others have primarily focused on injuries resulting in a hospital emergency department visit or admission.^{3 4 7-13} Few studies have examined work status following injury outside a hospital recruitment setting.^{14 15} However when considering the total burden of injury, many seemingly “minor” injuries that do not result in hospitalisation, such as soft tissue injuries, can result in substantial time away from the workplace for rehabilitation and recovery.

Researchers investigating return to work following injury have utilised different times to follow-up and different risk factors, outcome measures, and sample populations. However, despite these differences socio-demographic, clinical and occupational factors have tended to be found to determine work status following injury.¹⁶⁻¹⁸ The need for broader examination of potential determinants of work status using a bio-psychosocial perspective in the trauma population was recently highlighted.¹⁸ For example, pre-injury health and lifestyle factors associated with return to work following lower back pain¹⁹ have rarely been examined and there has been limited examination of potential psychosocial risk factors following injury.¹⁸ In New Zealand, research appears to have been limited to examining time on compensation in workers with chronic back pain.²⁰

New Zealand’s universal no-fault compensation scheme (administered by the Accident Compensation Corporation – ACC) provides the opportunity to examine determinants of work status for workers with

1
2 compensated injuries sustained in a broader context. The aim of this paper is to examine the
3
4 combined influences of socio-demographic, occupational, pre-existing health and lifestyle factors and
5
6 injury, as predictors of work status three months following injury in a cohort of injured New Zealand
7
8 workers.
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10

11 12 13 14 15 **METHODS**

16 17 18 19 20 **Study setting**

21
22 The Prospective Outcomes of Injury Study (POIS) cohort was recruited via New Zealand's no-fault
23
24 Accident Compensation Corporation scheme. POIS participants include those who consulted with a
25
26 primary or secondary health care professional for an injury, and then consequently, were placed on the
27
28 Accident Compensation Corporation's entitlement claims register. This register is comprised of people
29
30 with an injury likely to require more than acute treatment only. For example, people likely to require a
31
32 week or more off work or home support and/or rehabilitation are placed on this register. POIS
33
34 participant's injuries were variously sustained in recreational, road, home, public, and workplace
35
36 settings. Injured people living in one of five regions of New Zealand aged 18-65 years, who had
37
38 sustained an injury between June 2007 and May 2009, identified via the Accident Compensation
39
40 Corporation scheme entitlement claims register were eligible for inclusion. The recruitment process
41
42 and resulting cohort has been described in detail elsewhere.^{21 22}
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53 **Data collection and explanatory variables**

54
55 Between December 2007 to August 2009, 2856 participants were recruited.²² Of these, 2626 (92%)
56
57 responded they were working for pay ('workforce active') prior to their injury, and they are the cohort
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59
60

1
2 presented in this paper. Self-reported data, including pre-injury characteristics were mainly collected
3
4 by telephone interview (89%) and postal survey (11%), on average, three months following injury.
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10 All explanatory variables are pre-injury measures, with the exception of the injury-related variables
11
12 which relate to the injury event itself. Each explanatory variable was selected on the basis of an a
13
14 priori hypothesis of a relationship with not working following injury, and/or having been identified in
15
16 previous studies.^{18 19} These measures, assessed at interview, have been grouped into seven
17
18
19 dimensions:
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21

22 1) socio-demographic (age, gender, income, highest qualification, occupation, relationship status, living
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24 arrangements, material standard of living, adequacy of household income, financial security);
25
26

27 2) physical work (repetitive hand movements, heavy lifting, physical exertion, standing, or working in
28
29 painful/tiring body positions);
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32 3) psychosocial (job strain, job support, job security, job satisfaction, optimism, self-efficacy, prior
33
34 depressive episode);
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37 4) work organisational (hours of work, number of days worked per week, employment contract,
38
39 multiple job holding) ;
40
41

42 5) lifestyle (alcohol consumption, current smoking status, Body Mass Index (BMI), exercise, sleep
43
44 quantity);
45
46

47 6) health (overall self-assessment for health, co-morbidities, pain or discomfort, prior injury, prior
48
49 disabling condition, work capacity);
50
51

52 7) injury-related (work-related injury, intent of injury, hospital admission, injury a threat to life, injury a
53
54 threat of serious disability, access to health services).
55
56

57 For more detailed information about the explanatory variables, see the online appendix 1.
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59
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Outcome

Work status was assessed using a single item “*Are you back at work following your injury?*” (yes, no).

A participant was considered to be working at time of interview, regardless of whether they were working with their pre-injury employer, a new employer or working under modified working conditions, such as reduced work hours. The majority (82%) of the cohort have had a week, or more, off work and received earnings-related compensation from the Accident Compensation Corporation scheme. The remainder may have had less time off work or been ineligible for earnings-related compensation. Not being in work at the time of interview is referred to in this paper as not working.

Data analysis

Frequency tables, summary statistics and binary logistic regression analyses were used to examine the relationship between not working and pre-injury characteristics and injury-related factors.

Initially dimensional models were built using multivariable logistic regression analyses of all study variables within each of the seven dimensions simultaneously entered into individual models. Age, gender, hospital admission, body region injured, and nature of injury were included in all models as potential confounders. Based upon participants’ descriptions body region injured (lower extremities; upper extremities; head and neck; spine and back; torso; and multiple body regions) and nature of injury (fractures; sprains and strains; concussion; open wound/amputations; contusion/superficial; other single injury type; and multiple injury types) were assigned using a modified version of the Barell Matrix.²³ Time since injury was included as a continuous variable into all analyses to account for the range in the timing of interviews after the injury event.

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5 An overall multidimensional model was built by entering explanatory variables from each of the seven
6
7 dimension models showing an association of $p < 0.20$ with not working as independent variables.

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10 Backward stepwise elimination (criteria $p < 0.10$) was used to select the final variables for inclusion.

11
12 Post-hoc testing of model using the Hosmer and Lemeshow goodness of fit test and area under the
13
14 curve was undertaken to assess model fit. Analyses were performed using STATA statistical package

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18 11.1.

19 20 21 22 23 **Ethics**

24
25 Ethical approval for this study was obtained from the New Zealand Multi-Region Ethics Committee.

26
27
28 Informed consent was obtained from all participants.

29 30 31 32 33 **RESULTS**

34
35 Of the 2626 POIS participants who were workforce-active pre-injury, 11 were missing responses to the
36
37 work-status question at the 3 month post injury survey and were excluded from this investigation. Of
38
39 the remaining 2615 workers, 720 (27%) reported not working at the time of interview (median time to
40
41 interview was 3.4 months after injury; interquartile range: 2.5 to 4.1 months).

42
43
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46
47
48 The mean age of participants was 41 years (SD 13 years). The majority of the cohort are male (63%),
49
50 had post-secondary qualifications (60%), and were employees (85%)(see online table 1). The median
51
52 annual personal income was \$45,000. Annual personal income was not provided by 16% of
53
54 participants. The predominant injury type was multiple injury types (39%), followed by sprains and
55
56 strains (26%) and fractures (17%). The lower (37%) and upper extremities (28%) were the most
57
58
59
60

frequent body regions injured, followed by multiple injury regions (18%). Thirty percent of the cohort reported hospital admission, while a further 36% reported attending an Emergency Department (without hospital admission).

Table 2 shows the dimension-specific multivariable analyses in relation to not working three months after injury. The following pre-injury variables had p-values <0.20 in the dimension-specific logistic regression modelling:

sociodemographics (age, gender, highest qualification, income, occupation, relationship status, adequacy of household income, financial security);

physical work (repetitive hand movements, heavy lifting, painful/tiring body positions, standing);

psychosocial (job strain, job support, job security, prior depressive episode);

work organisational (hours of work, number of days worked per week, employment contract);

lifestyle (current smoking status, BMI, exercise, sleep quantity);

health (co-morbidities, prior injury, pain or discomfort); and

injury-related (work-related injury, injury a threat to life, intent of injury, hospital admission).

In order to identify the strongest predictors of not working across all dimensions, all these variables were entered in a multivariable logistic regression analysis.

Table 2: Dimension level multivariable analyses for not working three months after injury.

| Dimension Model | Adjusted* odds ratio (95% CI) | p-value |
|--|-------------------------------|---------|
| Variable | | |
| Model 1: Pre-injury socio-demographic factors (n=2368) | | |

| | | | |
|----|-------------------------------|---------------------|--------|
| 1 | | | |
| 2 | | | |
| 3 | Age | | |
| 4 | | | |
| 5 | 18-24 | Ref | 0.05 |
| 6 | | | |
| 7 | 25-34 | 0.72 (0.49 to 1.05) | |
| 8 | | | |
| 9 | | | |
| 10 | 35-44 | 1.12 (0.77 to 1.63) | |
| 11 | | | |
| 12 | 45-54 | 1.07 (0.73 to 1.57) | |
| 13 | | | |
| 14 | 55-64 | 0.94 (0.62 to 1.42) | |
| 15 | | | |
| 16 | | | |
| 17 | Gender | | |
| 18 | | | |
| 19 | | | |
| 20 | Male | Ref | 0.2 |
| 21 | | | |
| 22 | Female | 0.87 (0.69 to 1.11) | |
| 23 | | | |
| 24 | | | |
| 25 | Highest qualification | | |
| 26 | | | |
| 27 | | | |
| 28 | Post secondary qualifications | Ref | 0.01 |
| 29 | | | |
| 30 | Secondary qualifications | 0.98 (0.77 to 1.24) | |
| 31 | | | |
| 32 | No formal qualifications | 1.44 (1.09 to 1.89) | |
| 33 | | | |
| 34 | | | |
| 35 | Income | | |
| 36 | | | |
| 37 | ≥\$50,001 | Ref | <0.001 |
| 38 | | | |
| 39 | \$30,001-\$50,000 | 1.24 (0.95 to 1.61) | |
| 40 | | | |
| 41 | ≤ \$30,000 | 1.81 (1.33 to 2.48) | |
| 42 | | | |
| 43 | No income given | 2.24 (1.63 to 3.07) | |
| 44 | | | |
| 45 | | | |
| 46 | Occupation | | |
| 47 | | | |
| 48 | | | |
| 49 | White collar | Ref | <0.001 |
| 50 | | | |
| 51 | Pink collar | 1.26 (0.94 to 1.68) | |
| 52 | | | |
| 53 | Blue collar | 2.15 (1.65 to 2.81) | |
| 54 | | | |
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|----|--|---------------------|--------|
| 1 | | | |
| 2 | | | |
| 3 | Unclassified | 1.14 (0.59 to 2.17) | |
| 4 | | | |
| 5 | Relationship Status | | |
| 6 | | | |
| 7 | | | |
| 8 | Married/De Facto/Civil Union | Ref | 0.1 |
| 9 | | | |
| 10 | Never married | 1.17 (0.84 to 1.62) | |
| 11 | | | |
| 12 | Separated/Divorced | 1.34 (0.92 to 1.94) | |
| 13 | | | |
| 14 | Widowed | 2.19 (0.94 to 5.12) | |
| 15 | | | |
| 16 | Living arrangements | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | Living alone | Ref | 0.3 |
| 21 | | | |
| 22 | Living with familial other | 1.31 (0.87 to 1.96) | |
| 23 | | | |
| 24 | Living with non-familial other | 1.37 (0.84 to 2.22) | |
| 25 | | | |
| 26 | Adequacy of household income | | |
| 27 | | | |
| 28 | | | |
| 29 | | | |
| 30 | Sufficient | Ref | 0.1 |
| 31 | | | |
| 32 | Insufficient | 1.17 (0.94 to 1.47) | |
| 33 | | | |
| 34 | Material standard of living | | |
| 35 | | | |
| 36 | | | |
| 37 | High/Fairly high | Ref | 0.4 |
| 38 | | | |
| 39 | Medium | 1.08 (0.87 to 1.35) | |
| 40 | | | |
| 41 | Fairly low/Low | 0.82 (0.49 to 1.35) | |
| 42 | | | |
| 43 | Financial security | | |
| 44 | | | |
| 45 | | | |
| 46 | Secure/Fairly secure | Ref | <0.001 |
| 47 | | | |
| 48 | Fairly insecure/Insecure | 1.55 (1.22 to 1.96) | |
| 49 | | | |
| 50 | | | |
| 51 | | | |
| 52 | | | |
| 53 | Model 2: Pre-injury physical work factors (n=2509) | | |
| 54 | | | |
| 55 | Repetitive hand movements | | |
| 56 | | | |
| 57 | | | |
| 58 | | | |
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|----|-------------------------------|---------------------|--------|
| 1 | | | |
| 2 | | | |
| 3 | Never | Ref | 0.09 |
| 4 | | | |
| 5 | Occasionally/sometimes | 0.78 (0.55 to 1.13) | |
| 6 | | | |
| 7 | ¼ to ½ the time | 0.77 (0.55 to 1.06) | |
| 8 | | | |
| 9 | | | |
| 10 | ¾ of time or greater | 1.03 (0.78 to 1.36) | |
| 11 | | | |
| 12 | Heavy lifting | | |
| 13 | | | |
| 14 | | | |
| 15 | Never | Ref | 0.05 |
| 16 | | | |
| 17 | Occasionally/sometimes | 1.29 (0.98 to 1.72) | |
| 18 | | | |
| 19 | ¼ to ½ the time | 1.37 (0.99 to 1.89) | |
| 20 | | | |
| 21 | | | |
| 22 | ¾ of time or greater | 1.66 (1.15 to 2.38) | |
| 23 | | | |
| 24 | | | |
| 25 | Painful/tiring body positions | | |
| 26 | | | |
| 27 | | | |
| 28 | Never | Ref | 0.001 |
| 29 | | | |
| 30 | Occasionally/sometimes | 1.17 (0.91 to 1.51) | |
| 31 | | | |
| 32 | ¼ to ½ the time | 1.96 (1.44 to 2.65) | |
| 33 | | | |
| 34 | | | |
| 35 | ¾ of time or greater | 1.61 (1.16 to 2.24) | |
| 36 | | | |
| 37 | Standing | | |
| 38 | | | |
| 39 | | | |
| 40 | Never | Ref | >0.001 |
| 41 | | | |
| 42 | Occasionally/sometimes | 1.65 (1.08 to 2.54) | |
| 43 | | | |
| 44 | ¼ to ½ the time | 1.32 (0.87 to 1.99) | |
| 45 | | | |
| 46 | | | |
| 47 | ¾ of time or greater | 2.03 (1.38 to 2.96) | |
| 48 | | | |
| 49 | Physical exertion | | |
| 50 | | | |
| 51 | | | |
| 52 | Never | Ref | 0.6 |
| 53 | | | |
| 54 | Occasionally/sometimes | 1.18 (0.88 to 1.59) | |
| 55 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | ¼ to ½ the time | 1.08 (0.78 to 1.49) | |
| 4 | | | |
| 5 | ¾ of time or greater | 1.19 (0.86 to 1.65) | |
| 6 | | | |
| 7 | <hr/> | | |
| 8 | Model 3: Pre-injury psychosocial factors (n=2362) | | |
| 9 | | | |
| 10 | Job strain | | |
| 11 | | | |
| 12 | Low strain | Ref | >0.001 |
| 13 | | | |
| 14 | Active | 0.88 (0.66 to 1.17) | |
| 15 | | | |
| 16 | Passive | 1.37 (1.02 to 1.83) | |
| 17 | | | |
| 18 | High strain | 1.52 (1.13 to 2.02) | |
| 19 | | | |
| 20 | Job support | | |
| 21 | | | |
| 22 | Quartile 1- High | Ref | 0.03 |
| 23 | | | |
| 24 | Quartile 2 | 0.65 (0.46 to 0.94) | |
| 25 | | | |
| 26 | Quartile 3 | 0.73 (0.57 to 0.94) | |
| 27 | | | |
| 28 | Quartile 4 – Low | 0.80 (0.61 to 1.04) | |
| 29 | | | |
| 30 | Job security | | |
| 31 | | | |
| 32 | Very secure | Ref | 0.03 |
| 33 | | | |
| 34 | Secure | 1.27 (1.02 to 1.59) | |
| 35 | | | |
| 36 | Insecure/very insecure | 1.46 (1.02 to 2.10) | |
| 37 | | | |
| 38 | Job satisfaction | | |
| 39 | | | |
| 40 | Completely/mostly satisfied | Ref | 0.4 |
| 41 | | | |
| 42 | Neither satisfied nor dissatisfied | 0.85 (0.61 to 1.20) | |
| 43 | | | |
| 44 | Mostly/completely dissatisfied | 0.80 (0.51 to 1.26) | |
| 45 | | | |
| 46 | Self-efficacy | | |
| 47 | | | |
| 48 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | Good | Ref | 0.2 |
| 4 | | | |
| 5 | Poor | 0.80 (0.56 to 1.14) | |
| 6 | | | |
| 7 | Optimism | | |
| 8 | | | |
| 9 | | | |
| 10 | Yes | Ref | 0.5 |
| 11 | | | |
| 12 | No | 1.09 (0.81 to 1.47) | |
| 13 | | | |
| 14 | | | |
| 15 | Prior depressive episode | | |
| 16 | | | |
| 17 | No | Ref | 0.03 |
| 18 | | | |
| 19 | Yes | 1.27 (1.02 to 1.59) | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | Model 4: Pre-injury work organisational factors (n=2518) | | |
| 24 | | | |
| 25 | Hours of work | | |
| 26 | | | |
| 27 | | | |
| 28 | ≤ 30 hrs | Ref | 0.004 |
| 29 | | | |
| 30 | 31-45 hrs | 0.84 (0.63 to 1.14) | |
| 31 | | | |
| 32 | 45-65 hrs | 0.86 (0.61 to 1.22) | |
| 33 | | | |
| 34 | ≥ 66 hrs | 1.32 (0.72 to 2.44) | |
| 35 | | | |
| 36 | | | |
| 37 | Number of days worked per week | | |
| 38 | | | |
| 39 | | | |
| 40 | ≤ 5 days | Ref | >0.001 |
| 41 | | | |
| 42 | 6-7 days | 1.68 (1.31 to 2.15) | |
| 43 | | | |
| 44 | | | |
| 45 | Employment contract | | |
| 46 | | | |
| 47 | Employee - permanent | Ref | >0.001 |
| 48 | | | |
| 49 | Employee - temporary/casual | 2.25 (1.58 to 3.20) | |
| 50 | | | |
| 51 | Employee - fixed term | 1.51 (0.98 to 2.35) | |
| 52 | | | |
| 53 | Employee - other contract types | 1.50 (0.76 to 2.98) | |
| 54 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | Self-employed | 1.20 (0.87 to 1.66) | |
| 4 | | | |
| 5 | Employer | 0.70 (0.44 to 1.12) | |
| 6 | | | |
| 7 | Multiple job holding | | |
| 8 | | | |
| 9 | | | |
| 10 | Yes | Ref | 0.8 |
| 11 | | | |
| 12 | No | 1.04 (0.74 to 1.45) | |
| 13 | | | |
| 14 | | | |
| 15 | Model 5: Pre-injury lifestyle factors (n=2445) | | |
| 16 | | | |
| 17 | Alcohol consumption | Ref | 0.6 |
| 18 | | | |
| 19 | Low | 0.95 (0.77 to 1.18) | |
| 20 | | | |
| 21 | High | | |
| 22 | | | |
| 23 | Current smoking status | | |
| 24 | | | |
| 25 | No | Ref | 0.009 |
| 26 | | | |
| 27 | Yes | 0.76 (0.62 to 0.93) | |
| 28 | | | |
| 29 | Body Mass Index | | |
| 30 | | | |
| 31 | ≤24 | Ref | >0.001 |
| 32 | | | |
| 33 | 25-29 | 1.24 (0.99 to 1.56) | |
| 34 | | | |
| 35 | ≥30 | 1.61 (1.26 to 2.05) | |
| 36 | | | |
| 37 | Exercise (days per week) | | |
| 38 | | | |
| 39 | 5-7 days | Ref | >0.001 |
| 40 | | | |
| 41 | ≤ 4 days | 0.63 (0.52 to 0.76) | |
| 42 | | | |
| 43 | Sleep quantity (per week) | | |
| 44 | | | |
| 45 | 5-7 nights obtaining ≥7hrs sleep | Ref | 0.1 |
| 46 | | | |
| 47 | ≤ 4 nights obtaining ≥7hrs sleep | 0.85 (0.68 to 1.07) | |
| 48 | | | |
| 49 | | | |
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 Model 6: Pre-injury health factors (n=2426)

| | | |
|------------------------------------|----------------------|------|
| Overall self-assessment for health | Ref | 0.4 |
| Excellent/Very Good | 0.91 (0.73 to 1.13) | |
| Good/Fair/Poor | | |
| Co-morbidities | | |
| No co-morbidities | Ref | 0.06 |
| 1 co-morbidities | 0.82 (0.66 to 1.04) | |
| 2 or more co-morbidities | 1.14 (0.87 to 1.48) | |
| Prior injury | | |
| No | Ref | 0.1 |
| Yes | 0.82 (0.63 to 1.06) | |
| Prior disabling condition | | |
| No | Ref | 0.7 |
| Yes | 1.04 (0.77 to 1.40) | |
| Pain or discomfort | | |
| None | Ref | 0.1 |
| Moderate | 1.00 (0.70 to 1.43) | |
| Extreme | 3.46 (0.93 to 12.78) | |
| Work capacity | | |
| High (≥ 7) | Ref | 0.9 |
| Low (< 7) | 1.01 (0.48 to 2.11) | |

 Model 7: Injury-related factors (n=2509)

| | | | |
|----|---------------------------------------|---------------------|--------|
| 1 | | | |
| 2 | | | |
| 3 | Work-related injury | | |
| 4 | | | |
| 5 | No | Ref | >0.001 |
| 6 | | | |
| 7 | Yes | 1.46 (1.21 to 1.78) | |
| 8 | | | |
| 9 | | | |
| 10 | Intent of injury event | | |
| 11 | | | |
| 12 | No | Ref | 0.07 |
| 13 | | | |
| 14 | Yes – assaultive | 1.55 (0.96 to 2.50) | |
| 15 | | | |
| 16 | | | |
| 17 | Injury a threat to life | | |
| 18 | | | |
| 19 | No | Ref | >0.001 |
| 20 | | | |
| 21 | Yes/Maybe | 1.94 (1.45 to 2.58) | |
| 22 | | | |
| 23 | | | |
| 24 | Injury a threat of serious disability | | |
| 25 | | | |
| 26 | No | Ref | 0.9 |
| 27 | | | |
| 28 | Yes/Maybe | 1.00 (0.82 to 1.21) | |
| 29 | | | |
| 30 | Hospital admission | | |
| 31 | | | |
| 32 | No | Ref | |
| 33 | | | |
| 34 | Yes | 1.74 (1.42 to 2.13) | >0.001 |
| 35 | | | |
| 36 | | | |
| 37 | Access to health services | | |
| 38 | | | |
| 39 | No difficulties accessing | Ref | |
| 40 | | | |
| 41 | Difficulties accessing | 0.95 (0.70 to 1.29) | 0.7 |
| 42 | | | |
| 43 | | | |
| 44 | | | |
| 45 | | | |
| 46 | | | |
| 47 | | | |

*All dimension-level models were adjusted for age, gender, hospital admission, body region injured, nature of injury & time since injury.

Table 3 presents the overall multidimensional logistic regression model identifying the strongest (as defined by the variable p-value <0.10) predictors of not working 3 months after injury. Several socio-

demographic factors were associated with greater odds of not working including: workers with a low personal income; those who gave no income; workers with a blue collar occupation and those reporting financial insecurity. While age was significantly associated with not working as a term, no individual age category was at significantly higher odds of not working compared to the reference of 18-24 year olds. Physical work conditions associated with increased odds of not working included those working in painful/tiring, or standing positions at work. Unlike the bivariate analysis, the association between not working and repetitive hand movements was not significant in the physical work factor model, however it remains in the overall multi-dimensional model as it fits the backwards stepwise elimination criteria ($p < 0.10$). Several work organisational factors were associated with greater odds of not working: workers with temporary/casual employment contracts compared to those with permanent contracts and workers with long-week work schedules compared to those working ≤ 5 days.

Table 3: Significant independent predictors of not working three months following injury. (n=2250)

| Explanatory variable | Work absent <i>n=609</i> | Adjusted * odds ratio | 95% CI | p-value |
|-----------------------|-----------------------------|--------------------------|--------------|---------|
| | N | | | |
| Sociodemographic: Age | | | | |
| 18-24 | 95 | Ref | | 0.004 |
| 25-34 | 96 | 0.73 | 0.50 to 1.07 | |
| 35-44 | 146 | 1.23 | 0.85 to 1.78 | |
| 45-54 | 172 | 1.33 | 0.92 to 1.91 | |
| 55-64 | 100 | 1.28 | 0.86 to 1.91 | |

Sociodemographic: Gender

| | | | |
|--------|-----|------|--------------|
| Male | 424 | Ref | 0.5 |
| Female | 185 | 0.93 | 0.72 to 1.20 |

Sociodemographic: Income

| | | | |
|------------------------|-----|------|--------------|
| ≥ \$50,000 | 140 | Ref | <0.001 |
| \$30,001-\$50,000 | 208 | 1.16 | 0.88 to 1.53 |
| ≤ \$30,000 | 149 | 1.52 | 1.09 to 2.12 |
| Refused to give income | 112 | 2.11 | 1.49 to 2.98 |

Sociodemographic: Financial security

| | | | |
|--------------------------|-----|------|--------------|
| Secure/Fairly secure | 436 | Ref | 0.006 |
| Fairly insecure/Insecure | 173 | 1.41 | 1.10 to 1.80 |

Sociodemographic: Occupation

| | | | |
|--------------|-----|------|--------------|
| White collar | 146 | Ref | 0.01 |
| Pink collar | 120 | 1.04 | 0.76 to 1.42 |
| Blue collar | 331 | 1.52 | 1.14 to 2.02 |
| Unclassified | 12 | 0.96 | 0.46 to 2.01 |

Physical work: Painful/tiring body positions

| | | | |
|------------------------|-----|------|--------------|
| Never | 216 | Ref | <0.001 |
| Occasionally/sometimes | 168 | 1.33 | 1.01 to 1.74 |
| ¼-½ the time | 116 | 2.12 | 1.54 to 2.92 |
| ¾ of time or greater | 109 | 1.93 | 1.38 to 2.72 |

Physical work: Standing

| | | | | |
|----|---|-----|------|--------------|
| 1 | | | | |
| 2 | | | | |
| 3 | never | 42 | Ref | <0.001 |
| 4 | | | | |
| 5 | occasionally/sometimes | 66 | 1.92 | 1.20 to 3.07 |
| 6 | | | | |
| 7 | ¼-½ the time | 91 | 1.60 | 1.03 to 2.49 |
| 8 | | | | |
| 9 | | | | |
| 10 | ¾ of time or greater | 410 | 2.25 | 1.51 to 3.34 |
| 11 | | | | |
| 12 | Physical work: Repetitive hand movements | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | never | 104 | Ref | 0.03 |
| 16 | | | | |
| 17 | occasionally/sometimes | 71 | 0.69 | 0.46 to 1.02 |
| 18 | | | | |
| 19 | ¼-½ the time | 107 | 0.76 | 0.53 to 1.09 |
| 20 | | | | |
| 21 | | | | |
| 22 | ¾ of time or greater | 327 | 1.04 | 0.76 to 1.42 |
| 23 | | | | |
| 24 | | | | |
| 25 | Work organisation: Employment contract | | | |
| 26 | | | | |
| 27 | | | | |
| 28 | Permanent | 410 | Ref | 0.02 |
| 29 | | | | |
| 30 | Temporary | 64 | 1.89 | 1.27 to 2.81 |
| 31 | | | | |
| 32 | Fixed term | 32 | 1.43 | 0.87 to 2.33 |
| 33 | | | | |
| 34 | Other or no formal contract | 12 | 1.62 | 0.73 to 3.59 |
| 35 | | | | |
| 36 | Self-employed | 62 | 1.10 | 0.76 to 1.59 |
| 37 | | | | |
| 38 | Employer | 29 | 0.82 | 0.49 to 1.36 |
| 39 | | | | |
| 40 | | | | |
| 41 | | | | |
| 42 | | | | |
| 43 | Work organisation: Number of days worked per week | | | |
| 44 | | | | |
| 45 | ≤5 days per week | 419 | Ref | <0.001 |
| 46 | | | | |
| 47 | 6-7 days per week | 190 | 1.54 | 1.21 to 1.96 |
| 48 | | | | |
| 49 | | | | |
| 50 | Lifestyle: BMI | | | |
| 51 | | | | |
| 52 | | | | |
| 53 | Under/normal weight (≤24) | 193 | Ref | 0.01 |
| 54 | | | | |
| 55 | Over weight (25-29) | 238 | 1.18 | 0.92 to 1.51 |
| 56 | | | | |
| 57 | | | | |
| 58 | | | | |
| 59 | | | | |
| 60 | | | | |

| | | | | |
|----|---|-----|------|--------------|
| 1 | | | | |
| 2 | | | | |
| 3 | Obese (≥ 30) | 178 | 1.48 | 1.13 to 1.94 |
| 4 | | | | |
| 5 | Lifestyle: Sleep quantity (nights ≥ 7 hrs sleep) | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | 5-7 nights | 475 | Ref | 0.06 |
| 9 | | | | |
| 10 | ≤ 4 nights | 134 | 0.79 | 0.61 to 1.01 |
| 11 | | | | |
| 12 | Lifestyle: Exercise (days per week) | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | 5-7 days | 392 | Ref | <0.001 |
| 16 | | | | |
| 17 | ≤ 4 days | 217 | 0.67 | 0.54 to 0.83 |
| 18 | | | | |
| 19 | | | | |
| 20 | Injury: Hospital admission | | | |
| 21 | | | | |
| 22 | | | | |
| 23 | No | 369 | Ref | <0.001 |
| 24 | | | | |
| 25 | Yes | 240 | 2.10 | 1.66 to 2.64 |
| 26 | | | | |
| 27 | | | | |
| 28 | Injury: Self-perceived threat to life | | | |
| 29 | | | | |
| 30 | No | 505 | Ref | <0.001 |
| 31 | | | | |
| 32 | Yes/Maybe | 104 | 1.90 | 1.38 to 2.62 |
| 33 | | | | |
| 34 | | | | |

*adjusted for body region injured, nature of injury, time since injury

While the overall Body Mass Index term did not have a significant association with not working in the overall model, obesity was significantly associated with increased odds of not working compared to the reference of normal Body Mass Index. The lifestyle factors of lower pre-injury exercise frequency was associated with reduced odds of not working. The other lifestyle factor pre-injury sleep was not associated with working status but remains in the model as it fits the model criteria. Injury-related factors associated with increased odds of not working that remained in the overall multi-dimensional model were: those workers who perceived their injury was a threat to their life and those who were admitted to hospital following their injury. None of the psychosocial or health factor variables

1
2
3 examined in this study remained in the overall multidimensional model. Diagnostic testing of the
4
5 overall model indicated goodness of fit was acceptable ($\chi^2=2279$, $p=0.13$) and the model had good
6
7 accuracy in correctly discriminating if a worker was absent from work (area under curve=0.76).²⁴
8
9

10 11 **DISCUSSION**

12
13 This paper presents evidence regarding pre-injury predictors of not working three months after injury.
14
15 The injuries sustained by this cohort were sufficient enough to potentially warrant at least one week of
16
17 entitlement compensation. The multivariable multidimensional model confirmed a set of important
18
19 pre-injury predictors of not working three months following injury. Specifically, our analysis confirmed
20
21 previous findings that certain socio-demographic, work and injury factors predict work status. This
22
23 study also broadened the focus to examine dimensions rarely examined previously and found work
24
25 organisation and lifestyle factors were also important predictors of work status. Psychosocial factors
26
27 were suggested in prior studies to be an important predictor of working after injury^{18 17}, however, of
28
29 the pre-injury psychosocial variables examined in this study, none were found to be important in
30
31 predicting work status. Health-related factors, rarely examined previously, were not found to be
32
33 important predictors of work status. Our findings further confirm the need for future studies to
34
35 examine a broader range of determinants and assess the relative importance of these for work
36
37 disability.¹⁸
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49 Our findings are consistent with many studies that demonstrate a relationship between work status
50
51 and economic security,¹⁶⁻¹⁸ with low income workers most likely to be absent from work compared
52
53 with high income workers. Additionally those who did not provide income for the income variable
54
55 were more likely to be absent from work. Further descriptive analysis, not presented here, found
56
57 these workers were most likely to be on employment contracts that result in fluctuating work patterns,
58
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1
2 suggesting these workers may find it difficult to provide an estimate of their annual personal income.
3
4 Financial insecurity, a marker of future economic security, was associated with not working. While
5
6 financial insecurity is a predictor of health outcomes,²⁵ there has been little examination of financial
7
8 insecurity in relation to work status following injury. Financial insecurity is thought to influence mental
9
10 health outcomes through anxiety generated by feelings of future economic insecurity.²⁵ This potential
11
12 pathway needs further examination with regard to work status.
13
14

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16
17 Occupational factors were important predictors of not working in our study. Previous studies using
18
19 various occupational classification schemes or categorisations across have reported mixed findings
20
21 regarding occupation.^{17 18} In our study, a blue collar occupation had a higher likelihood of not working.
22
23
24 Our findings are consistent with previous cohort studies reporting blue collar workers as less likely to
25
26 have returned to work following injury adding further strength to the evidence for a causal
27
28 relationship.^{17 18} Physical work tasks involving painful/tiring body positions or standing were at
29
30 increased likelihood of not working. Exposure to physical work tasks or blue collar work in general are
31
32 commonly associated with an increased risk of not working following injury.^{17 18} However, specific
33
34 ergonomic hazards are rarely examined with regard to work status and our study identifies potentially
35
36 modifiable workplace ergonomic hazard exposures that are associated with not working.
37
38
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40
41 Aspects of work organisation are rarely examined in injury populations and our study found two
42
43 important groups of workers at increased likelihood of not working: temporary and long-week workers.
44
45
46 Temporary employees have the poorest social and employment protections, working conditions and
47
48 higher risk of unemployment when compared with the permanent workforce.²⁶ Our finding that
49
50 workers with temporary employment were more likely to be not working compared to those in other
51
52 types of employment possibly reflects difficulties for employees in: retaining their jobs following injury;
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1
2 negotiating a modified return to work; or in obtaining new employment in a tight labour market.

3
4
5 Studies examining long-term sickness absence report lower rates of absence for temporary employees,
6
7 suggesting poor social protections are a key determinant of sickness absence-taking behaviour.^{27 28}
8
9

10 Further examination of potential social and material pathways through which temporary employment
11
12 can impinge upon the return to work process is warranted. Long-week work schedules also predicted
13
14 not working. While long-week work schedules have not specifically been found to be associated with
15
16 not working that we are aware of, other non-standard work schedules, such as long-day work
17
18 schedules, have been reported to disrupt a full return to work following workplace injury.²⁹
19
20
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24

25 Our study found obese workers were more likely to not be working three months following injury.

26
27 Increasingly studies are showing relationships between obesity, and illness-related work disability.³⁰⁻³²
28
29

30 However, few studies have investigated the impact of pre-injury obesity on work status following
31
32 injury.³⁰ Obesity is often associated with a long list of chronic health conditions and while this
33
34 multivariable analysis examined the presence of co-morbidities, more specific examination is needed
35
36 to explain our findings.
37
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43 Contradictory to expectations those who had higher levels of exercise prior to injury were less likely to
44
45 have returned to work in our study. Our findings differ to those of a study demonstrating those with
46
47 moderate fitness prior to injury are more likely to have returned to work three months following a
48
49 whiplash injury.³³ Those workers used to getting regular exercise prior to their injury may have
50
51 experienced a substantial change in their exercise patterns as a consequence of their injury.
52
53
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55 Conceivably, they may have to cope with fewer exercise opportunities – with possible impacts on their
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3 ability to work. This may not be occurring to the same extent among workers already used to irregular
4
5 exercise before injury.
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8
9

10 Two injury-related factors were strongly associated with increased odds of not working: workers who
11
12 perceived that their injury was a threat to their life and those whose injury resulted in hospital
13
14 admission. While it might be reasonable to explain these observations by considering injury severity,
15
16 examination of hospital admission and threat to life within our cohort found the two variables were
17
18 measuring independent effects. Perceived threat to life is strongly associated with post-traumatic
19
20 stress disorder,³⁴ and post-traumatic stress disorder has been found to be strongly associated with
21
22 failure to work following injury^{35 36}. Further work to examine potential pathways of effect is required.
23
24
25
26
27

28 Our finding that hospital admission predicts not working three months following injury corroborates
29
30 previous findings in the few studies to include non-hospitalised injuries that report that intensive care
31
32 admission and length of hospital stay predicts work status.⁹
33
34
35

36 The findings from our multidimensional analysis of a wide spectrum of injuries indicate interventions to
37
38 improve opportunities for working in the short-term following injury need to target a broad range
39
40 factors. As we have found some previously-unreported findings, these will need to be confirmed with
41
42 additional research. However, our findings indicate some self-reported pre-injury measures of socio-
43
44 demographic, workplace and lifestyle-related factors could be used to identify individuals with
45
46 increased odds of not working three months after injury. This paper identifies a number of pre-injury
47
48 factors which are potentially amenable to primary intervention, such as workplace hazard exposures,
49
50 obesity and physical exercise. For example, workplace physical activity interventions have been shown
51
52 to improve worksite outcomes, such as sick leave.³⁷ If confirmed, our findings would suggest that
53
54 primary workforce interventions focusing on lifestyle-related factors may contribute to a reduction in
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56
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1
2 rates of not working three months following injury, as well as contributing to maintaining a healthy and
3
4
5 productive workforce.
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10
11 The strengths of the study include the collection of pre-injury information, large sample size, inclusion
12
13 of traditionally-conceived 'less severe' non-hospitalised injuries, and the collection and combined
14
15 multivariable examination of a wide range of potential determinants of work status. Consequently we
16
17 have found a number of important and previously unreported associations generating new hypotheses
18
19 for further examination. There are a few limitations to our study. This study relies on self-reported
20
21 survey data with baseline data collected retrospectively at the time of first interview: consequently
22
23 recall bias might occur. However, workers were specifically directed to consider their pre-injury
24
25 exposures and few of the pre-injury variables examined in this analysis are likely to be influenced by
26
27 their status at the time of interview. A further limitation is the design of New Zealand's Accident
28
29 Compensation Corporation compensation system meaning the findings of this study are potentially not
30
31 generalisable beyond no-fault compensation systems. The universal nature of the Accident
32
33 Compensation Corporation scheme also means we cannot examine compensation status. There is
34
35 moderate evidence that the receipt and extent of compensation has a negative effect upon returning
36
37 to work following injury in healthcare systems where only certain causes of injury receive
38
39 compensation, such as those caused by a motor vehicle traffic crash or while at work.^{4 38} However, it is
40
41 a strength of the study that the universal nature of this scheme allows us to examine predictors of
42
43 work status in the short term in a broader population context of injury and work than previously
44
45 examined.
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In conclusion, this study indicates a number of pre-injury socio-demographic, occupational and lifestyle factors, as well as injury factors, were associated with not working three months after injury in a sample of New Zealand workers. This study confirms that the predictors of work status following injury are multidimensional and that future studies need to examine a broader range of determinants for work disability. If these findings are confirmed, intervention strategies aimed at identifying workers at increased risk of not working and improving work status in the short-term following injury should address multiple dimensions of the worker and workplace.

Article Summary

Article Focus

- Previous examinations of predictors of work status following injury have focused primarily on hospitalised patients and a limited range of risk factors; this study examines multidimensional predictors of work status three months following hospitalised and non-hospitalised injuries.

Key Message

- While previous findings on socio-demographic and work factors were confirmed, a number of rarely-examined variables were associated with increased odds of not working including: obesity, temporary employment, long-day work schedules and financial insecurity.
- Contrary to expectations, workers who were infrequent exercisers prior to injury were more likely to be working after injury.
- This study identified a range of potential predictors of not working that, if causal, help identify workers at increased risk of not working three months after injury. If confirmed, intervention strategies should target these groups to reduce short-term work disability.

Strengths and Limitations

- The strengths of the study include the collection of pre-injury information, large sample size, inclusion of non-hospitalised and hospitalised injuries, and the collection and combined multivariable examination of a wide range of potential determinants of work status. Consequently this study has generated new hypotheses for further examination.
- This study relies on self-reported survey data with baseline data collected retrospectively at the time of first interview: consequently recall bias might occur. However, few of the pre-injury variables examined in this analysis are likely to be influenced by their status at the time of interview. The design of New Zealand's universal no-fault injury compensation system may limit the generalisability of study findings beyond similar systems. However, the universal nature of the New Zealand scheme allows the examination of predictors of work status in a broader population context of injury and work than previously examined.

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DATA SHARING

Data sharing will be considered on a case by case basis by application to the research team.

CONTRIBUTORSHIP

RL was involved in the design of the data collection tools, cleaned and analysed the data, interpreted the data, drafted and revised the paper. RL is guarantor. GD cleaned the data, provided statistical advice, interpreted the data and critically reviewed the paper. AS was involved in the initiation and design of the study, data interpretation and critically revised the paper. SD designed and implemented the study, managed data collection, interpreted the data, and critically reviewed the paper.

COMPETING INTERESTS

None declared

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STROBE Statement—checklist of items that should be included in reports of observational studies

Checklist for: “Factors predicting work status 3 months after injury: results from the Prospective Outcome of Injury Study” Lilley R, Davie G, Ameratunga S, Derrett S.

| | Item No | Recommendation | Author Check |
|---------------------------|---------|--|-----------------|
| Title and abstract | 1 | (a) Indicate the study’s design with a commonly used term in the title or the abstract | Yes |
| | | (b) Provide in the abstract an informative and balanced summary of what was done and what was found | Yes |
| Introduction | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | Yes |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | Yes |
| Methods | | | |
| Study design | 4 | Present key elements of study design early in the paper | Yes |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | Yes |
| Participants | 6 | (a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants | Yes |
| | | (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case | N/A |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | Yes |
| Data sources/measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | Yes |
| Bias | 9 | Describe any efforts to address potential sources of bias | Yes |
| Study size | 10 | Explain how the study size was arrived at | Reference given |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | Yes |
| Statistical methods | 12 | (a) Describe all statistical methods, including those used to control for confounding | Yes |
| | | (b) Describe any methods used to examine subgroups and interactions | Yes |
| | | (c) Explain how missing data were addressed | Yes |
| | | (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy | N/A |

(e) Describe any sensitivity analyses

N/A

Results

| | | | |
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| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | Yes |
| | | (b) Give reasons for non-participation at each stage | Yes |
| | | (c) Consider use of a flow diagram | N/A |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | Yes |
| | | (b) Indicate number of participants with missing data for each variable of interest | No – can calculate from table |
| | | (c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount) | Yes |
| Outcome data | 15* | <i>Cohort study</i> —Report numbers of outcome events or summary measures over time | Yes |
| | | <i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure | N/A |
| | | <i>Cross-sectional study</i> —Report numbers of outcome events or summary measures | N/A |
| Main results | 16 | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | Yes |
| | | (b) Report category boundaries when continuous variables were categorized | Yes |
| | | (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | N/A |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | Yes |
| Discussion | | | |
| Key results | 18 | Summarise key results with reference to study objectives | Yes |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | Yes |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | Yes |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | Yes |
| Other information | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | Yes |



**Factors predicting work status three months after injury:
results from the Prospective Outcome of Injury Study**

| | |
|---------------------------------|--|
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| Primary Subject Heading: | Public health |
| Secondary Subject Heading: | Epidemiology, Occupational and environmental medicine, Rehabilitation medicine |
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| | | (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | N/A |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | Yes |

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| Key results | 18 | Summarise key results with reference to study objectives | Yes |
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| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | Yes |
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Other information

| | | | |
|---------|----|---|-----|
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | Yes |
|---------|----|---|-----|

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3 **Factors predicting work status three months after injury: results from the Prospective Outcome of**
4
5 **Injury Study**
6

7 **Rebecca Lilley¹, Gabrielle Davie¹, Shanthi Ameratunga², Sarah Derrett¹**
8
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36 Counts: main text 3571 words; abstract 224 words; figures 0; tables 3; appendices 1
37

38 **Key words:** Wounds and injuries; work; rehabilitation, vocational; cohort study.
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ABSTRACT

Objective: Few studies examine predictors of work status following injury beyond injuries presenting to a hospital or emergency department. This paper examines the combined influences of socio-demographic, occupational, injury, and pre-existing health and lifestyle factors as predictors of work status three months after hospitalised and non-hospitalised injury in a cohort of injured New Zealand workers.

Design: Prospective cohort study

Setting: The Prospective Outcomes of Injury Study, New Zealand.

Participants: 2626 workforce active participants were identified from the Prospective Outcomes of Injury Study; 11 participants with missing outcome responses were excluded.

Primary and secondary outcome measures: The primary outcome of interest was 'not working' at the time of interview.

Results: 720 (27%) reported 'not working' three months after injury. Multidimensional modelling found the most important pre-injury predictors of not working following injury were: low or unknown income, financial insecurity, physical work tasks, temporary employment, long-week schedules, obesity, perceived threat to life and hospital admission. Contrary to expectations, workers reporting less frequent exercise pre-injury had lower odds of work absence. Pre-injury psychosocial and health factors were not associated with not working.

Conclusion: Certain pre-injury socio-demographic, physical work, work organisation, lifestyle and injury-related factors were associated with not working three months after injury. If these findings are confirmed, intervention strategies aimed at improving return to work should address multiple dimensions of both the worker and workplace.

BACKGROUND

A timely and sustainable return to work is a crucial rehabilitation outcome for workers following injury, as prolonged work absences result in significant personal and societal costs.^{1 2} Many studies investigating factors associated with work status following injury are restricted to particular injury types or body regions.³⁻⁶ Others have primarily focused on injuries resulting in a hospital emergency department visit or admission.^{3 4 7-13} Few studies have examined work status following injury outside a hospital recruitment setting.^{14 15} However when considering the total burden of injury, many seemingly “minor” injuries that do not result in hospitalisation, such as soft tissue injuries, can result in substantial time away from the workplace for rehabilitation and recovery.

Researchers investigating return to work following injury have utilised different times to follow-up and different risk factors, outcome measures, and sample populations. However, despite these differences socio-demographic, clinical and occupational factors are commonly associated with work status following injury.¹⁶⁻¹⁸ The need for broader examination of potential determinants of work status using a bio-psychosocial perspective in the trauma population was recently highlighted.¹⁸ For example, pre-injury health and lifestyle factors associated with return to work following lower back pain¹⁹ have rarely been examined and there has been limited examination of potential psychosocial risk factors following injury.¹⁸ In New Zealand, research appears to have been limited to examining time on compensation in workers with chronic back pain.²⁰

New Zealand’s universal no-fault compensation scheme (administered by the Accident Compensation Corporation – ACC) provides the opportunity to examine determinants of work status for workers with

1
2 compensated injuries sustained in a broader context. The aim of this paper is to examine the
3
4 combined influences of socio-demographic, occupational, pre-existing health and lifestyle factors and
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6 injury, as predictors of work status three months following injury in a cohort of injured New Zealand
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8 workers.
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11 12 13 14 15 **METHODS**

16 17 18 19 20 **Study setting**

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22 The Prospective Outcomes of Injury Study (POIS) cohort was recruited via New Zealand's no-fault, non-
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24 tortious ACC scheme. People were not eligible to participate if their injury was the result of self-harm,
25
26 or if their injury resulted in their being placed on ACC's sensitive claims register (e.g. sexual assault).
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28 POIS participants include those who consulted with a primary or secondary health care professional for
29
30 an injury, and then consequently, were placed on ACC's entitlement claims register. Each year there
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32 are approximately 1.75 million injuries claims in New Zealand.²¹ Of these, 7% are placed on an
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34 entitlement claimants register because they are likely to require more than simple medical treatment.
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36 For example, people likely to require a week or more off work or home support and/or rehabilitation
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38 are placed on this register. POIS participant's injuries were variously sustained in recreational, road,
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40 home, public, and workplace settings. Injured people living in one of five regions of New Zealand aged
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42 18-65 years, who had sustained an injury between June 2007 and May 2009, identified via the ACC
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44 scheme entitlement claims register were eligible for inclusion. The recruitment process and resulting
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46 cohort has been described in detail elsewhere.^{22 23}
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58 **Data collection and explanatory variables**

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3 Between December 2007 to August 2009, 2856 participants were recruited.²³ Of these, 2626 (92%)
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5 responded they were working for pay ('workforce active') prior to their injury, and they are the cohort
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7 presented in this paper. Of the 2626 POIS participants who were workforce-active pre-injury, 11 were
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9 missing responses to the work-status question at the 3 month post injury survey and were excluded
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11 from this investigation. Of the remaining 2615 workers, 720 (27%) reported not working at the time of
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13 interview (median time to interview was 3.4 months after injury; interquartile range: 2.5 to 4.1
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15 months). Self-reported data, including pre-injury characteristics were mainly collected by telephone
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17 interview (89%) and postal survey (11%), on average, three months following injury.
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21 All explanatory variables are pre-injury measures retrospectively collected at the 3 month interview,
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23 with the exception of the injury-related variables which relate to the injury event itself. Each
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25 explanatory variable was selected on the basis of an a priori hypothesis of a relationship with not
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27 working following injury, and/or having been identified in previous studies.^{18 19} These measures,
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29 assessed at interview, have been grouped into seven dimensions:
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- 32 1) socio-demographic (age, gender, income, highest qualification, occupation, relationship status, living
33 arrangements, material standard of living, adequacy of household income, financial security);
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- 35 2) physical work (repetitive hand movements, heavy lifting, physical exertion, standing, or working in
36 painful/tiring body positions);
37
- 38 3) psychosocial (job strain, job support, job security, job satisfaction, optimism, self-efficacy, prior
39 depressive episode);
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- 41 4) work organisational (hours of work, number of days worked per week, employment contract,
42 multiple job holding) ;
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3 5) lifestyle (alcohol consumption, current smoking status, Body Mass Index (BMI), exercise, sleep
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5 quantity);

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8 6) health (overall self-assessment for health, co-morbidities, pain or discomfort, prior injury, prior
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10 disabling condition, work capacity);

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12 7) injury-related (work-related injury, intent of injury, hospital admission, injury a threat to life, injury a
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14 threat of serious disability, access to health services).

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17 For more detailed information about the explanatory variables, see the online appendix 1.
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20 21 22 **Outcome**

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25 Work status was assessed using a single item “*Are you back at work following your injury?*” (yes, no).
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28 A participant was considered to be working at time of interview, regardless of whether they were
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30 working with their pre-injury employer, a new employer or working under modified working
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32 conditions, such as reduced work hours. The majority (82%) of the cohort have had a week, or more,
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34 off work and received earnings-related compensation from the ACC scheme. The remainder may have
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36 had less time off work or been ineligible for earnings-related compensation. Not being in work at the
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38 time of interview is referred to in this paper as not working.
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45 **Data analysis**

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48 Frequency tables, summary statistics and binary logistic regression analyses were used to examine the
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50 relationship between not working and pre-injury characteristics and injury-related factors.
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55 Initially dimensional models were built using multivariable logistic regression analyses of all study
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57 variables within each of the seven dimensions simultaneously entered into individual models. Age,
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1
2 gender, hospital admission, body region injured, and nature of injury were included in all models as
3 potential confounders. Based upon participants' descriptions body region injured (lower extremities;
4 upper extremities; head and neck; spine and back; torso; and multiple body regions) and nature of
5 injury (fractures; sprains and strains; concussion; open wound/amputations; contusion/superficial;
6 other single injury type; and multiple injury types) were assigned using a modified version of the Barell
7 Matrix.²⁴ Time since injury was included as a continuous variable into all analyses to account for the
8 range in the timing of interviews after the injury event.
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23 An overall multidimensional model was built by entering explanatory variables from each of the seven
24 dimension models showing an association of $p < 0.20$ with not working as independent variables.
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27 Backward stepwise elimination (criteria $p < 0.10$) was used to select the final variables for inclusion.
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30 Post-hoc testing of model using the Hosmer and Lemeshow goodness of fit test and area under the
31 curve was undertaken to assess model fit. Analyses were performed using STATA statistical package
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40 Ethics

41 Ethical approval for this study was obtained from the New Zealand Multi-Region Ethics Committee.
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45 Informed consent was obtained from all participants.
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50 RESULTS

51 The mean age of participants was 41 years (SD 13 years). The majority of the cohort are male (63%),
52 had post-secondary qualifications (60%), and were employees (85%)(see online table 1). The median
53 annual personal income was \$45,000. Annual personal income was not provided by 16% of
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participants. The predominant injury type was multiple injury types (39%), followed by sprains and strains (26%) and fractures (17%). The lower (37%) and upper extremities (28%) were the most frequent body regions injured, followed by multiple injury regions (18%). Thirty percent of the cohort reported hospital admission, while a further 36% reported attending an Emergency Department (without hospital admission).

Table 2 shows the dimension-specific multivariable analyses in relation to not working three months after injury. The following pre-injury variables had p-values <0.20 in the dimension-specific logistic regression modelling:

sociodemographics (age, gender, highest qualification, income, occupation, relationship status, adequacy of household income, financial security);

physical work (repetitive hand movements, heavy lifting, painful/tiring body positions, standing);

psychosocial (job strain, job support, job security, prior depressive episode);

work organisational (hours of work, number of days worked per week, employment contract);

lifestyle (current smoking status, BMI, exercise, sleep quantity);

health (co-morbidities, prior injury, pain or discomfort); and

injury-related (work-related injury, injury a threat to life, intent of injury, hospital admission).

In order to identify the strongest predictors of not working across all dimensions, all these variables were entered in a multivariable logistic regression analysis.

Table 2: Dimension level multivariable analyses for not working three months after injury.

| Dimension Model | Adjusted* odds ratio (95% CI) | p-value |
|-----------------|-------------------------------|---------|
|-----------------|-------------------------------|---------|

| Variable | | |
|--|---------------------|--------|
| Model 1: Pre-injury socio-demographic factors (n=2368) | | |
| Age | | |
| 18-24 | Ref | 0.05 |
| 25-34 | 0.72 (0.49 to 1.05) | |
| 35-44 | 1.12 (0.77 to 1.63) | |
| 45-54 | 1.07 (0.73 to 1.57) | |
| 55-64 | 0.94 (0.62 to 1.42) | |
| Gender | | |
| Male | Ref | 0.2 |
| Female | 0.87 (0.69 to 1.11) | |
| Highest qualification | | |
| Post secondary qualifications | Ref | 0.01 |
| Secondary qualifications | 0.98 (0.77 to 1.24) | |
| No formal qualifications | 1.44 (1.09 to 1.89) | |
| Income | | |
| ≥\$50,001 | Ref | <0.001 |
| \$30,001-\$50,000 | 1.24 (0.95 to 1.61) | |
| ≤ \$30,000 | 1.81 (1.33 to 2.48) | |
| No income given | 2.24 (1.63 to 3.07) | |
| Occupation | | |
| White collar | Ref | <0.001 |

| | | | |
|----|--------------------------------|---------------------|--------|
| 1 | | | |
| 2 | | | |
| 3 | Pink collar | 1.26 (0.94 to 1.68) | |
| 4 | | | |
| 5 | Blue collar | 2.15 (1.65 to 2.81) | |
| 6 | | | |
| 7 | Unclassified | 1.14 (0.59 to 2.17) | |
| 8 | | | |
| 9 | | | |
| 10 | Relationship Status | | |
| 11 | | | |
| 12 | Married/De Facto/Civil Union | Ref | 0.1 |
| 13 | | | |
| 14 | Never married | 1.17 (0.84 to 1.62) | |
| 15 | | | |
| 16 | Separated/Divorced | 1.34 (0.92 to 1.94) | |
| 17 | | | |
| 18 | Widowed | 2.19 (0.94 to 5.12) | |
| 19 | | | |
| 20 | Living arrangements | | |
| 21 | | | |
| 22 | Living alone | Ref | 0.3 |
| 23 | | | |
| 24 | Living with familial other | 1.31 (0.87 to 1.96) | |
| 25 | | | |
| 26 | Living with non-familial other | 1.37 (0.84 to 2.22) | |
| 27 | | | |
| 28 | Adequacy of household income | | |
| 29 | | | |
| 30 | Sufficient | Ref | 0.1 |
| 31 | | | |
| 32 | Insufficient | 1.17 (0.94 to 1.47) | |
| 33 | | | |
| 34 | Material standard of living | | |
| 35 | | | |
| 36 | High/Fairly high | Ref | 0.4 |
| 37 | | | |
| 38 | Medium | 1.08 (0.87 to 1.35) | |
| 39 | | | |
| 40 | Fairly low/Low | 0.82 (0.49 to 1.35) | |
| 41 | | | |
| 42 | Financial security | | |
| 43 | | | |
| 44 | Secure/Fairly secure | Ref | <0.001 |
| 45 | | | |
| 46 | Fairly insecure/Insecure | 1.55 (1.22 to 1.96) | |
| 47 | | | |
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 Model 2: Pre-injury physical work factors (n=2509)

Repetitive hand movements

| | | |
|------------------------|---------------------|------|
| Never | Ref | 0.09 |
| Occasionally/sometimes | 0.78 (0.55 to 1.13) | |
| ¼ to ½ the time | 0.77 (0.55 to 1.06) | |
| ¾ of time or greater | 1.03 (0.78 to 1.36) | |

Heavy lifting

| | | |
|------------------------|---------------------|------|
| Never | Ref | 0.05 |
| Occasionally/sometimes | 1.29 (0.98 to 1.72) | |
| ¼ to ½ the time | 1.37 (0.99 to 1.89) | |
| ¾ of time or greater | 1.66 (1.15 to 2.38) | |

Painful/tiring body positions

| | | |
|------------------------|---------------------|-------|
| Never | Ref | 0.001 |
| Occasionally/sometimes | 1.17 (0.91 to 1.51) | |
| ¼ to ½ the time | 1.96 (1.44 to 2.65) | |
| ¾ of time or greater | 1.61 (1.16 to 2.24) | |

Standing

| | | |
|------------------------|---------------------|--------|
| Never | Ref | >0.001 |
| Occasionally/sometimes | 1.65 (1.08 to 2.54) | |
| ¼ to ½ the time | 1.32 (0.87 to 1.99) | |
| ¾ of time or greater | 2.03 (1.38 to 2.96) | |

Physical exertion

| | | | |
|----|---|---------------------|--------|
| 1 | | | |
| 2 | | | |
| 3 | Never | Ref | 0.6 |
| 4 | | | |
| 5 | Occasionally/sometimes | 1.18 (0.88 to 1.59) | |
| 6 | | | |
| 7 | ¼ to ½ the time | 1.08 (0.78 to 1.49) | |
| 8 | | | |
| 9 | | | |
| 10 | ¾ of time or greater | 1.19 (0.86 to 1.65) | |
| 11 | | | |
| 12 | <hr/> | | |
| 13 | Model 3: Pre-injury psychosocial factors (n=2362) | | |
| 14 | | | |
| 15 | Job strain | | |
| 16 | | | |
| 17 | Low strain | Ref | >0.001 |
| 18 | | | |
| 19 | Active | 0.88 (0.66 to 1.17) | |
| 20 | | | |
| 21 | Passive | 1.37 (1.02 to 1.83) | |
| 22 | | | |
| 23 | High strain | 1.52 (1.13 to 2.02) | |
| 24 | | | |
| 25 | Job support | | |
| 26 | | | |
| 27 | Quartile 1- High | Ref | 0.03 |
| 28 | | | |
| 29 | Quartile 2 | 0.65 (0.46 to 0.94) | |
| 30 | | | |
| 31 | Quartile 3 | 0.73 (0.57 to 0.94) | |
| 32 | | | |
| 33 | Quartile 4 – Low | 0.80 (0.61 to 1.04) | |
| 34 | | | |
| 35 | Job security | | |
| 36 | | | |
| 37 | Very secure | Ref | 0.03 |
| 38 | | | |
| 39 | Secure | 1.27 (1.02 to 1.59) | |
| 40 | | | |
| 41 | Insecure/very insecure | 1.46 (1.02 to 2.10) | |
| 42 | | | |
| 43 | Job satisfaction | | |
| 44 | | | |
| 45 | Completely/mostly satisfied | Ref | 0.4 |
| 46 | | | |
| 47 | Neither satisfied nor dissatisfied | 0.85 (0.61 to 1.20) | |
| 48 | | | |
| 49 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | Mostly/completely dissatisfied | 0.80 (0.51 to 1.26) | |
| 4 | | | |
| 5 | Self-efficacy | | |
| 6 | | | |
| 7 | Good | Ref | 0.2 |
| 8 | | | |
| 9 | Poor | 0.80 (0.56 to 1.14) | |
| 10 | | | |
| 11 | Optimism | | |
| 12 | | | |
| 13 | Yes | Ref | 0.5 |
| 14 | | | |
| 15 | No | 1.09 (0.81 to 1.47) | |
| 16 | | | |
| 17 | Prior depressive episode | | |
| 18 | | | |
| 19 | No | Ref | 0.03 |
| 20 | | | |
| 21 | Yes | 1.27 (1.02 to 1.59) | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | | | |
| 26 | | | |
| 27 | | | |
| 28 | Model 4: Pre-injury work organisational factors (n=2518) | | |
| 29 | | | |
| 30 | Hours of work | | |
| 31 | | | |
| 32 | ≤ 30 hrs | Ref | 0.004 |
| 33 | | | |
| 34 | 31-45 hrs | 0.84 (0.63 to 1.14) | |
| 35 | | | |
| 36 | 45-65 hrs | 0.86 (0.61 to 1.22) | |
| 37 | | | |
| 38 | ≥ 66 hrs | 1.32 (0.72 to 2.44) | |
| 39 | | | |
| 40 | Number of days worked per week | | |
| 41 | | | |
| 42 | ≤ 5 days | Ref | >0.001 |
| 43 | | | |
| 44 | 6-7 days | 1.68 (1.31 to 2.15) | |
| 45 | | | |
| 46 | Employment contract | | |
| 47 | | | |
| 48 | Employee - permanent | Ref | >0.001 |
| 49 | | | |
| 50 | Employee - temporary/casual | 2.25 (1.58 to 3.20) | |
| 51 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | Employee - fixed term | 1.51 (0.98 to 2.35) | |
| 4 | | | |
| 5 | Employee - other contract types | 1.50 (0.76 to 2.98) | |
| 6 | | | |
| 7 | Self-employed | 1.20 (0.87 to 1.66) | |
| 8 | | | |
| 9 | Employer | 0.70 (0.44 to 1.12) | |
| 10 | | | |
| 11 | | | |
| 12 | Multiple job holding | | |
| 13 | | | |
| 14 | Yes | Ref | 0.8 |
| 15 | | | |
| 16 | No | 1.04 (0.74 to 1.45) | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | <hr/> Model 5: Pre-injury lifestyle factors (n=2445) | | |
| 21 | | | |
| 22 | Alcohol consumption | | |
| 23 | | | |
| 24 | Low | Ref | 0.6 |
| 25 | | | |
| 26 | High | 0.95 (0.77 to 1.18) | |
| 27 | | | |
| 28 | Current smoking status | | |
| 29 | | | |
| 30 | No | Ref | 0.009 |
| 31 | | | |
| 32 | Yes | 0.76 (0.62 to 0.93) | |
| 33 | | | |
| 34 | Body Mass Index | | |
| 35 | | | |
| 36 | ≤24 | Ref | >0.001 |
| 37 | | | |
| 38 | 25-29 | 1.24 (0.99 to 1.56) | |
| 39 | | | |
| 40 | ≥30 | 1.61 (1.26 to 2.05) | |
| 41 | | | |
| 42 | Exercise (days per week) | | |
| 43 | | | |
| 44 | 5-7 days | Ref | >0.001 |
| 45 | | | |
| 46 | ≤ 4 days | 0.63 (0.52 to 0.76) | |
| 47 | | | |
| 48 | Sleep quantity (per week) | | |
| 49 | | | |
| 50 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | 5-7 nights obtaining ≥ 7 hrs sleep | Ref | 0.1 |
| 4 | | | |
| 5 | ≤ 4 nights obtaining ≥ 7 hrs sleep | 0.85 (0.68 to 1.07) | |
| 6 | | | |
| 7 | <hr/> | | |
| 8 | Model 6: Pre-injury health factors (n=2426) | | |
| 9 | Overall self-assessment for health | | |
| 10 | | | |
| 11 | | | |
| 12 | Excellent/Very Good | Ref | 0.4 |
| 13 | | | |
| 14 | Good/Fair/Poor | 0.91 (0.73 to 1.13) | |
| 15 | | | |
| 16 | | | |
| 17 | Co-morbidities | | |
| 18 | | | |
| 19 | | | |
| 20 | No co-morbidities | Ref | 0.06 |
| 21 | | | |
| 22 | 1 co-morbidities | 0.82 (0.66 to 1.04) | |
| 23 | | | |
| 24 | 2 or more co-morbidities | 1.14 (0.87 to 1.48) | |
| 25 | | | |
| 26 | | | |
| 27 | Prior injury | | |
| 28 | | | |
| 29 | No | Ref | 0.1 |
| 30 | | | |
| 31 | Yes | 0.82 (0.63 to 1.06) | |
| 32 | | | |
| 33 | | | |
| 34 | Prior disabling condition | | |
| 35 | | | |
| 36 | No | Ref | 0.7 |
| 37 | | | |
| 38 | Yes | 1.04 (0.77 to 1.40) | |
| 39 | | | |
| 40 | | | |
| 41 | Pain or discomfort | | |
| 42 | | | |
| 43 | None | Ref | 0.1 |
| 44 | | | |
| 45 | Moderate | 1.00 (0.70 to 1.43) | |
| 46 | | | |
| 47 | Extreme | 3.46 (0.93 to 12.78) | |
| 48 | | | |
| 49 | | | |
| 50 | Work capacity | | |
| 51 | | | |
| 52 | High (≥ 7) | Ref | 0.9 |
| 53 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | Low (<7) | 1.01 (0.48 to 2.11) | |
| 4 | | | |
| 5 | Model 7: Injury-related factors (n=2509) | | |
| 6 | | | |
| 7 | Work-related injury | | |
| 8 | | | |
| 9 | | | |
| 10 | No | Ref | >0.001 |
| 11 | | | |
| 12 | Yes | 1.46 (1.21 to 1.78) | |
| 13 | | | |
| 14 | Intent of injury event | | |
| 15 | | | |
| 16 | | | |
| 17 | No | Ref | 0.07 |
| 18 | | | |
| 19 | Yes – assaultive | 1.55 (0.96 to 2.50) | |
| 20 | | | |
| 21 | Injury a threat to life | | |
| 22 | | | |
| 23 | | | |
| 24 | No | Ref | >0.001 |
| 25 | | | |
| 26 | Yes/Maybe | 1.94 (1.45 to 2.58) | |
| 27 | | | |
| 28 | Injury a threat of serious disability | | |
| 29 | | | |
| 30 | | | |
| 31 | No | Ref | 0.9 |
| 32 | | | |
| 33 | Yes/Maybe | 1.00 (0.82 to 1.21) | |
| 34 | | | |
| 35 | Hospital admission | | |
| 36 | | | |
| 37 | | | |
| 38 | No | Ref | |
| 39 | | | |
| 40 | Yes | 1.74 (1.42 to 2.13) | >0.001 |
| 41 | | | |
| 42 | Access to health services | | |
| 43 | | | |
| 44 | | | |
| 45 | No difficulties accessing | Ref | |
| 46 | | | |
| 47 | Difficulties accessing | 0.95 (0.70 to 1.29) | 0.7 |
| 48 | | | |
| 49 | | | |
| 50 | | | |
| 51 | | | |
| 52 | | | |
| 53 | *All dimension-level models were adjusted for age, gender, hospital admission, body region injured, | | |
| 54 | nature of injury & time since injury. | | |
| 55 | | | |
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Table 3 presents the overall multidimensional logistic regression model identifying the strongest (as defined by the variable p-value <0.10) predictors of not working 3 months after injury. Several socio-demographic factors were associated with greater odds of not working including: workers with a low personal income; those who gave no income; workers with a blue collar occupation and those reporting financial insecurity. While age was significantly associated with not working as a term, no individual age category was at significantly higher odds of not working compared to the reference of 18-24 year olds. Physical work conditions associated with increased odds of not working included those working in painful/tiring, or standing positions at work. Unlike the bivariate analysis, the association between not working and repetitive hand movements was not significant in the physical work factor model, however it remains in the overall multi-dimensional model as it fits the backwards stepwise elimination criteria (p<0.10). Several work organisational factors were associated with greater odds of not working: workers with temporary/casual employment contracts compared to those with permanent contracts and workers with long-week work schedules compared to those working ≤5 days.

Table 3: Significant independent predictors of not working three months following injury. (n=2250)

| Explanatory variable | Work absent <i>n=609</i> N | Adjusted * odds ratio | 95% CI | p-value |
|-----------------------|----------------------------------|--------------------------|--------------|---------|
| Sociodemographic: Age | | | | |
| 18-24 | 95 | Ref | | 0.004 |
| 25-34 | 96 | 0.73 | 0.50 to 1.07 | |
| 35-44 | 146 | 1.23 | 0.85 to 1.78 | |

| | | | | |
|----|--|-----|------|--------------|
| 1 | | | | |
| 2 | | | | |
| 3 | 45-54 | 172 | 1.33 | 0.92 to 1.91 |
| 4 | | | | |
| 5 | 55-64 | 100 | 1.28 | 0.86 to 1.91 |
| 6 | | | | |
| 7 | Sociodemographic: Gender | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | Male | 424 | Ref | 0.5 |
| 11 | | | | |
| 12 | Female | 185 | 0.93 | 0.72 to 1.20 |
| 13 | | | | |
| 14 | | | | |
| 15 | Sociodemographic: Income | | | |
| 16 | | | | |
| 17 | ≥ \$50,000 | 140 | Ref | <0.001 |
| 18 | | | | |
| 19 | \$30,001-\$50,000 | 208 | 1.16 | 0.88 to 1.53 |
| 20 | | | | |
| 21 | ≤ \$30,000 | 149 | 1.52 | 1.09 to 2.12 |
| 22 | | | | |
| 23 | Refused to give income | 112 | 2.11 | 1.49 to 2.98 |
| 24 | | | | |
| 25 | | | | |
| 26 | | | | |
| 27 | | | | |
| 28 | Sociodemographic: Financial security | | | |
| 29 | | | | |
| 30 | Secure/Fairly secure | 436 | Ref | 0.006 |
| 31 | | | | |
| 32 | Fairly insecure/Insecure | 173 | 1.41 | 1.10 to 1.80 |
| 33 | | | | |
| 34 | | | | |
| 35 | Sociodemographic: Occupation | | | |
| 36 | | | | |
| 37 | White collar | 146 | Ref | 0.01 |
| 38 | | | | |
| 39 | Pink collar | 120 | 1.04 | 0.76 to 1.42 |
| 40 | | | | |
| 41 | Blue collar | 331 | 1.52 | 1.14 to 2.02 |
| 42 | | | | |
| 43 | Unclassified | 12 | 0.96 | 0.46 to 2.01 |
| 44 | | | | |
| 45 | | | | |
| 46 | | | | |
| 47 | | | | |
| 48 | Physical work: Painful/tiring body positions | | | |
| 49 | | | | |
| 50 | Never | 216 | Ref | <0.001 |
| 51 | | | | |
| 52 | Occasionally/sometimes | 168 | 1.33 | 1.01 to 1.74 |
| 53 | | | | |
| 54 | ¼-½ the time | 116 | 2.12 | 1.54 to 2.92 |
| 55 | | | | |
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|----|---|-----|------|--------------|
| 1 | | | | |
| 2 | | | | |
| 3 | ¾ of time or greater | 109 | 1.93 | 1.38 to 2.72 |
| 4 | | | | |
| 5 | Physical work: Standing | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | never | 42 | Ref | <0.001 |
| 9 | | | | |
| 10 | occasionally/sometimes | 66 | 1.92 | 1.20 to 3.07 |
| 11 | | | | |
| 12 | ¼-½ the time | 91 | 1.60 | 1.03 to 2.49 |
| 13 | | | | |
| 14 | ¾ of time or greater | 410 | 2.25 | 1.51 to 3.34 |
| 15 | | | | |
| 16 | | | | |
| 17 | Physical work: Repetitive hand movements | | | |
| 18 | | | | |
| 19 | | | | |
| 20 | never | 104 | Ref | 0.03 |
| 21 | | | | |
| 22 | occasionally/sometimes | 71 | 0.69 | 0.46 to 1.02 |
| 23 | | | | |
| 24 | ¼-½ the time | 107 | 0.76 | 0.53 to 1.09 |
| 25 | | | | |
| 26 | ¾ of time or greater | 327 | 1.04 | 0.76 to 1.42 |
| 27 | | | | |
| 28 | | | | |
| 29 | Work organisation: Employment contract | | | |
| 30 | | | | |
| 31 | | | | |
| 32 | Permanent | 410 | Ref | 0.02 |
| 33 | | | | |
| 34 | Temporary | 64 | 1.89 | 1.27 to 2.81 |
| 35 | | | | |
| 36 | Fixed term | 32 | 1.43 | 0.87 to 2.33 |
| 37 | | | | |
| 38 | Other or no formal contract | 12 | 1.62 | 0.73 to 3.59 |
| 39 | | | | |
| 40 | Self-employed | 62 | 1.10 | 0.76 to 1.59 |
| 41 | | | | |
| 42 | Employer | 29 | 0.82 | 0.49 to 1.36 |
| 43 | | | | |
| 44 | | | | |
| 45 | Work organisation: Number of days worked per week | | | |
| 46 | | | | |
| 47 | | | | |
| 48 | ≤5 days per week | 419 | Ref | <0.001 |
| 49 | | | | |
| 50 | 6-7 days per week | 190 | 1.54 | 1.21 to 1.96 |
| 51 | | | | |
| 52 | | | | |
| 53 | Lifestyle: BMI | | | |
| 54 | | | | |
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|---|-----|------|--------------|--------|
| Under/normal weight (≤ 24) | 193 | Ref | | 0.01 |
| Over weight (25-29) | 238 | 1.18 | 0.92 to 1.51 | |
| Obese (≥ 30) | 178 | 1.48 | 1.13 to 1.94 | |
| Lifestyle: Sleep quantity (nights ≥ 7 hrs sleep) | | | | |
| 5-7 nights | 475 | Ref | | 0.06 |
| ≤ 4 nights | 134 | 0.79 | 0.61 to 1.01 | |
| Lifestyle: Exercise (days per week) | | | | |
| 5-7 days | 392 | Ref | | <0.001 |
| ≤ 4 days | 217 | 0.67 | 0.54 to 0.83 | |
| Injury: Hospital admission | | | | |
| No | 369 | Ref | | <0.001 |
| Yes | 240 | 2.10 | 1.66 to 2.64 | |
| Injury: Self-perceived threat to life | | | | |
| No | 505 | Ref | | <0.001 |
| Yes/Maybe | 104 | 1.90 | 1.38 to 2.62 | |

*adjusted for body region injured, nature of injury, time since injury

While the overall Body Mass Index term did not have a significant association with not working in the overall model, obesity was significantly associated with increased odds of not working compared to the reference of normal Body Mass Index. The lifestyle factors of lower pre-injury exercise frequency was associated with reduced odds of not working. The other lifestyle factor pre-injury sleep was not associated with working status but remains in the model as it fits the model criteria. Injury-related factors associated with increased odds of not working that remained in the overall multi-dimensional

1
2
3 model were: those workers who perceived their injury was a threat to their life and those who were
4
5 admitted to hospital following their injury. None of the psychosocial or health factor variables
6
7 examined in this study remained in the overall multidimensional model. Diagnostic testing of the
8
9 overall model indicated goodness of fit was acceptable ($\chi^2=2279$, $p=0.13$) and the model had good
10
11 accuracy in correctly discriminating if a worker was absent from work (area under curve=0.76).²⁵ The
12
13 pseudo R^2 was 0.1533.
14
15

16 17 18 **DISCUSSION**

19
20 This paper presents evidence regarding pre-injury predictors of not working three months after injury.
21
22 The injuries sustained by this cohort were sufficient enough to potentially warrant at least one week of
23
24 entitlement compensation. The multivariable multidimensional model confirmed a set of important
25
26 pre-injury predictors of not working three months following injury. Specifically, our analysis confirmed
27
28 previous findings that certain socio-demographic, work and injury factors predict work status. This
29
30 study also broadened the focus to examine dimensions rarely examined previously and found work
31
32 organisation and lifestyle factors were also important predictors of work status. Psychosocial factors
33
34 were suggested in prior studies to be an important predictor of working after injury^{18 17}, however, of
35
36 the pre-injury psychosocial variables examined in this study, none were found to be important in
37
38 predicting work status. Our study simultaneously controlled for a broader range of determinants than
39
40 have previously been investigated by researchers examining the association between psychosocial
41
42 variables and work status, and this may offer one explanation why there was a lack of association
43
44 between psychosocial factors and work status in our study. Health-related factors, rarely examined
45
46 previously, were not found to be important predictors of work status. Our findings further confirm the
47
48 need for future studies to examine a broader range of determinants and assess the relative importance
49
50 of these for work disability.¹⁸
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5 Our findings are consistent with many studies that demonstrate a relationship between work status
6 and economic security,¹⁶⁻¹⁸ with low income workers most likely to be absent from work compared
7 with high income workers. Additionally those who did not provide income for the income variable
8 were more likely to be absent from work. Further descriptive analysis, not presented here, found
9 these workers were most likely to be on employment contracts that result in fluctuating work patterns,
10 suggesting these workers may find it difficult to provide an estimate of their annual personal income.
11 Financial insecurity, a marker of future economic security, was associated with not working. While
12 financial insecurity is a predictor of health outcomes,²⁶ there has been little examination of financial
13 insecurity in relation to work status following injury. Financial insecurity is thought to influence mental
14 health outcomes through anxiety generated by feelings of future economic insecurity.²⁶ This potential
15 pathway needs further examination with regard to work status.
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33 Occupational factors were important predictors of not working in our study. Previous studies using
34 various occupational classification schemes or categorisations across have reported mixed findings
35 regarding occupation.^{17 18} In our study, a blue collar occupation had a higher likelihood of not working.
36 Our findings are consistent with previous cohort studies reporting blue collar workers as less likely to
37 have returned to work following injury adding further strength to the evidence for a causal
38 relationship.^{17 18} Physical work tasks involving painful/tiring body positions or standing were at
39 increased likelihood of not working. Exposure to physical work tasks or blue collar work in general are
40 commonly associated with an increased risk of not working following injury.^{17 18} However, specific
41 ergonomic hazards are rarely examined with regard to work status and our study identifies potentially
42 modifiable workplace ergonomic hazard exposures that are associated with not working.
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2 Aspects of work organisation are rarely examined in injury populations and our study found two
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4 important groups of workers at increased likelihood of not working: temporary and long-week workers.
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7 Temporary employees have the poorest social and employment protections, working conditions and
8
9 higher risk of unemployment when compared with the permanent workforce.²⁷ Our finding that
10
11 workers with temporary employment were more likely to be not working compared to those in other
12
13 types of employment possibly reflects difficulties for employees in: retaining their jobs following injury;
14
15 negotiating a modified return to work; or in obtaining new employment in a tight labour market.
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18 Studies examining long-term sickness absence report lower rates of absence for temporary employees,
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20 suggesting poor social protections are a key determinant of sickness absence-taking behaviour.^{28 29}
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23 Further examination of potential social and material pathways through which temporary employment
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25 can impinge upon the return to work process is warranted. Long-week work schedules also predicted
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27 not working. While long-week work schedules have not specifically been found to be associated with
28
29 not working that we are aware of, other non-standard work schedules, such as long-day work
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31 schedules, have been reported to disrupt a full return to work following workplace injury.³⁰
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40 Our study found obese workers were more likely to not be working three months following injury.
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42 Increasingly studies are showing relationships between obesity, and illness-related work disability.³¹⁻³³
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45 However, few studies have investigated the impact of pre-injury obesity on work status following
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47 injury.³¹ Obesity is often associated with a long list of chronic health conditions and while this
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49 multivariable analysis examined the presence of co-morbidities, more specific examination is needed
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51 to explain our findings.
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Contradictory to expectations those who had higher levels of exercise prior to injury were less likely to have returned to work in our study. Our findings differ to those of a study demonstrating those with moderate fitness prior to injury are more likely to have returned to work three months following a whiplash injury.³⁴ Those workers used to getting regular exercise prior to their injury may have experienced a substantial change in their exercise patterns as a consequence of their injury.

Conceivably, they may have to cope with fewer exercise opportunities – with possible impacts on their ability to work. This may not be occurring to the same extent among workers already used to irregular exercise before injury.

Two injury-related factors were strongly associated with increased odds of not working: workers who perceived that their injury was a threat to their life and those whose injury resulted in hospital admission. While it might be reasonable to explain these observations by considering injury severity, examination of hospital admission and threat to life within our cohort found the two variables were measuring independent effects. Perceived threat to life is strongly associated with post-traumatic stress disorder,³⁵ and post-traumatic stress disorder has been found to be strongly associated with failure to work following injury^{36,37}. Further work to examine potential pathways of effect is required. Our finding that hospital admission predicts not working three months following injury corroborates previous findings in the few studies to include non-hospitalised injuries that report that intensive care admission and length of hospital stay predicts work status.⁹

The findings from our multidimensional analysis of a wide spectrum of injuries indicate interventions to improve opportunities for working in the short-term following injury need to target a broad range factors. As we have found some previously-unreported findings, these will need to be confirmed with additional research. However, our findings indicate some self-reported pre-injury measures of socio-

1
2 demographic, workplace and lifestyle-related factors could be used to identify individuals with
3
4 increased odds of not working three months after injury. This paper identifies a number of pre-injury
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6 factors which are potentially amenable to primary intervention, such as workplace hazard exposures,
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8 obesity and physical exercise. For example, workplace physical activity interventions have been shown
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10 to improve worksite outcomes, such as sick leave.³⁸ If confirmed, our findings would suggest that
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12 primary workforce interventions focusing on lifestyle-related factors may contribute to a reduction in
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14 rates of not working three months following injury, as well as contributing to maintaining a healthy and
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16 productive workforce.
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26 The strengths of the study include the collection of pre-injury information, large sample size, inclusion
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28 of traditionally-conceived 'less severe' non-hospitalised injuries, and the collection and combined
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30 multivariable examination of a wide range of potential determinants of work status. Consequently we
31
32 have found a number of important and previously unreported associations generating new hypotheses
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34 for further examination. There are a few limitations to our study. This study relies on self-reported
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36 survey data with baseline data collected retrospectively at the time of first interview: consequently
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38 recall bias might occur. However, workers were specifically directed to consider their pre-injury
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40 exposures and few of the pre-injury variables examined in this analysis are likely to be influenced by
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42 their status at the time of interview. The exception to this are the psychosocial factors that may be
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44 subject to recall bias. If so, this could have contributed to a lack of relationship between psychosocial
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46 factors and not working following injury. Recall of the baseline pre-injury work status at the 3 month
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48 interview may be subject to recall bias. However, verification of employment status with ACC claims
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50 records indicates the likelihood of this is low with 1% of participants having a non-concordant
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52 employment status between the self-reported and claims record data. The use of single item
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measures for psychological constructs, such as job satisfaction and optimism, is a potential limitation to this study. However, parsimonious measures have been found to demonstrate good reliability and validity. Furthermore, we were concerned to minimise participant interview burden (the interview took 60 minutes to complete). A further limitation is the design of New Zealand's no-fault ACC compensation system meaning the findings of this study are potentially not generalisable beyond no-fault compensation systems. However, the no-fault nature of ACC is also a strength of our study. In other injury-compensation systems, where people are required to litigate to gain access to compensation following injury, incentives may exist such that people would be ill-advised to return to work prior to their legal case for compensation coming before the court. Recruiting participants, via the universal no-fault ACC scheme does not allow us to examine work status outcome in relation to whether or not people were granted access to ACC. There may be injured New Zealanders, not included in our study, who did not access medical support from a health professional for their injury (a necessary requirement to become registered with ACC), or, who were not referred to ACC by a health professional. There is moderate evidence that the receipt and extent of compensation has a negative effect upon returning to work following injury in healthcare systems where only certain causes of injury receive compensation, such as those caused by a motor vehicle traffic crash or while at work.^{4 39} However, it is a strength of the study that the universal nature of this scheme allows us to examine predictors of work status in the short-term in a broader population context of injury and work than previously examined.

In conclusion, this study indicates a number of pre-injury socio-demographic, occupational and lifestyle factors, as well as injury factors, were associated with not working three months after injury in a sample of New Zealand workers. This study confirms that the predictors of work status following injury

1
2 are multidimensional and that future studies need to examine a broader range of determinants for
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4 work disability. If these findings are confirmed, intervention strategies aimed at identifying workers at
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6 increased risk of not working and improving work status in the short-term following injury should
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9 address multiple dimensions of the worker and workplace.
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15 Article Summary

16 Article Focus

- 17 • Previous examinations of predictors of work status following injury have focused primarily on
18 hospitalised patients and a limited range of risk factors; this study examines multidimensional
19 predictors of work status three months following hospitalised and non-hospitalised injuries.
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28 Key Message

- 29 • While previous findings on socio-demographic and work factors were confirmed, a number of
30 rarely-examined variables were associated with increased odds of not working including:
31 obesity, temporary employment, long-day work schedules and financial insecurity.
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- 38 • Contrary to expectations, workers who were infrequent exercisers prior to injury were more
39 likely to be working after injury.
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- 42 • This study identified a range of potential predictors of not working that, if causal, help identify
43 workers at increased risk of not working three months after injury. If confirmed, intervention
44 strategies should target these groups to reduce short-term work disability.
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50 Strengths and Limitations

- 51 • The strengths of the study include the collection of pre-injury information, large sample size,
52 inclusion of non-hospitalised and hospitalised injuries, and the collection and combined
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multivariable examination of a wide range of potential determinants of work status.

Consequently this study has generated new hypotheses for further examination.

- This study relies on self-reported survey data with baseline data collected retrospectively at the time of first interview: consequently recall bias might occur. However, few of the pre-injury variables examined in this analysis are likely to be influenced by their status at the time of interview. The design of New Zealand's universal no-fault injury compensation system may limit the generalisability of study findings beyond similar systems. However, the universal nature of the New Zealand scheme allows the examination of predictors of work status in a broader population context of injury and work than previously examined.

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3 The funders of this project provided funding for salary and working expenses and had no input in the
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5 study design, data collection, data analysis or interpretation with the sole exception of the Accident
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7 Compensation Corporation who provided the initial sampling list.
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10 11 12 **COMPETING INTERESTS**

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15 None declared
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3 **Factors predicting work status three months after injury: results from the Prospective Outcome of**
4
5 **Injury Study**
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7 **Rebecca Lilley¹, Gabrielle Davie¹, Shanthi Ameratunga², Sarah Derrett¹**
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38 **Key words:** Wounds and injuries; work; rehabilitation, vocational; cohort study.
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ABSTRACT

Objective: Few studies examine predictors of work status following injury beyond injuries presenting to a hospital or emergency department. This paper examines the combined influences of socio-demographic, occupational, injury, and pre-existing health and lifestyle factors as predictors of work status three months after hospitalised and non-hospitalised injury in a cohort of injured New Zealand workers.

Design: Prospective cohort study

Setting: The Prospective Outcomes of Injury Study, New Zealand.

Participants: 2626 workforce active participants were identified from the Prospective Outcomes of Injury Study; 11 participants with missing outcome responses were excluded.

Primary and secondary outcome measures: The primary outcome of interest was 'not working' at the time of interview.

~~**Methods:** Workforce active participants (n=2626) were identified from the Prospective Outcomes of Injury Study, a cohort study of injured people registered with New Zealand's national no-fault insurance agency. Seven dimensions were considered: six pre-injury dimensions (socio-demographic, physical work, psychosocial, work organisation, lifestyle, health) plus an injury-related dimension. The outcome of interest was 'not working' at the time of interview. Multivariable logistic regression models were built for each of the seven dimensions and an overall multi-dimensional model.~~

Results: 720 (27%) reported 'not working' three months after injury. Multidimensional modelling found the most important pre-injury predictors of not working following injury were: low or unknown income, financial insecurity, physical work tasks, temporary employment, long-week schedules, obesity, perceived threat to life and hospital admission. Contrary to expectations, workers reporting

1
2 less frequent exercise pre-injury had lower odds of work absence. Pre-injury psychosocial and health
3 factors were not associated with not working.
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7 **Conclusion:** Certain pre-injury socio-demographic, physical work, work organisation, lifestyle and
8 injury-related factors were associated with not working three months after injury. If these findings are
9 confirmed, intervention strategies aimed at improving return to work should address multiple
10 dimensions of both the worker and workplace.
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BACKGROUND

A timely and sustainable return to work is a crucial rehabilitation outcome for workers following injury, as prolonged work absences result in significant personal and societal costs.^{1 2} Many studies investigating factors associated with work status following injury are restricted to particular injury types or body regions.³⁻⁶ Others have primarily focused on injuries resulting in a hospital emergency department visit or admission.^{3 4 7-13} Few studies have examined work status following injury outside a hospital recruitment setting.^{14 15} However when considering the total burden of injury, many seemingly “minor” injuries that do not result in hospitalisation, such as soft tissue injuries, can result in substantial time away from the workplace for rehabilitation and recovery.

Researchers investigating return to work following injury have utilised different times to follow-up and different risk factors, outcome measures, and sample populations. However, despite these differences socio-demographic, clinical and occupational factors ~~have tended to be been found to determine are~~ commonly associated with work status following injury.¹⁶⁻¹⁸ The need for broader examination of potential determinants of work status using a bio-psychosocial perspective in the trauma population was recently highlighted.¹⁸ For example, pre-injury health and lifestyle factors associated with return to work following lower back pain¹⁹ have rarely been examined and there has been limited examination of potential psychosocial risk factors following injury.¹⁸ In New Zealand, research appears to have been limited to examining time on compensation in workers with chronic back pain.²⁰

New Zealand’s universal no-fault compensation scheme (administered by the Accident Compensation Corporation – ACC) provides the opportunity to examine determinants of work status for workers with

1
2 compensated injuries sustained in a broader context. The aim of this paper is to examine the
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4 combined influences of socio-demographic, occupational, pre-existing health and lifestyle factors and
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6 injury, as predictors of work status three months following injury in a cohort of injured New Zealand
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8 workers.
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11 12 13 14 15 **METHODS**

16 17 18 19 20 **Study setting**

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22 The Prospective Outcomes of Injury Study (POIS) cohort was recruited via New Zealand's no-fault, non-
23 tortious Accident Compensation Corporation ACC scheme. People were not eligible to participate if
24 their injury was the result of self-harm, or if their injury resulted in their being placed on ACC's
25 sensitive claims register (e.g. sexual assault). POIS participants include those who consulted with a
26
27 primary or secondary health care professional for an injury, and then consequently, were placed on ~~the~~
28 ~~Accident Compensation Corporation's ACC's~~ entitlement claims register. Each year there are
29 approximately 1.75 million injuries claims in New Zealand.²¹ Of these, 7% are placed on an entitlement
30 claimants register because they are likely to require more than simple medical treatment. This register
31 ~~is comprised of people with an injury likely to require more than acute treatment only.~~ For example,
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33 people likely to require a week or more off work or home support and/or rehabilitation are placed on
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35 this register. POIS participant's injuries were variously sustained in recreational, road, home, public,
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37 and workplace settings. Injured people living in one of five regions of New Zealand aged 18-65 years,
38
39 who had sustained an injury between June 2007 and May 2009, identified via the ~~Accident~~
40 ~~Compensation Corporation ACC~~ scheme entitlement claims register were eligible for inclusion. The
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42 recruitment process and resulting cohort has been described in detail elsewhere.^{22 23}
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Data collection and explanatory variables

Between December 2007 to August 2009, 2856 participants were recruited.²³ Of these, 2626 (92%) responded they were working for pay ('workforce active') prior to their injury, and they are the cohort presented in this paper. Of the 2626 POIS participants who were workforce-active pre-injury, 11 were missing responses to the work-status question at the 3 month post injury survey and were excluded from this investigation. Of the remaining 2615 workers, 720 (27%) reported not working at the time of interview (median time to interview was 3.4 months after injury; interquartile range: 2.5 to 4.1 months). Self-reported data, including pre-injury characteristics were mainly collected by telephone interview (89%) and postal survey (11%), on average, three months following injury.

All explanatory variables are pre-injury measures retrospectively collected at the 3 month interview, with the exception of the injury-related variables which relate to the injury event itself. Each explanatory variable was selected on the basis of an a priori hypothesis of a relationship with not working following injury, and/or having been identified in previous studies.^{18 19} These measures, assessed at interview, have been grouped into seven dimensions:

- 1) socio-demographic (age, gender, income, highest qualification, occupation, relationship status, living arrangements, material standard of living, adequacy of household income, financial security);
- 2) physical work (repetitive hand movements, heavy lifting, physical exertion, standing, or working in painful/tiring body positions);
- 3) psychosocial (job strain, job support, job security, job satisfaction, optimism, self-efficacy, prior depressive episode);

1
2
3 4) work organisational (hours of work, number of days worked per week, employment contract,
4
5 multiple job holding) ;
6

7
8 5) lifestyle (alcohol consumption, current smoking status, Body Mass Index (BMI), exercise, sleep
9
10 quantity);
11

12
13 6) health (overall self-assessment for health, co-morbidities, pain or discomfort, prior injury, prior
14
15 disabling condition, work capacity);
16

17
18 7) injury-related (work-related injury, intent of injury, hospital admission, injury a threat to life, injury a
19
20 threat of serious disability, access to health services).
21

22 For more detailed information about the explanatory variables, see the online appendix 1.
23
24
25
26
27

28 Outcome

29
30 Work status was assessed using a single item “*Are you back at work following your injury?*” (yes, no).
31

32
33 A participant was considered to be working at time of interview, regardless of whether they were
34
35 working with their pre-injury employer, a new employer or working under modified working
36
37 conditions, such as reduced work hours. The majority (82%) of the cohort have had a week, or more,
38
39 off work and received earnings-related compensation from the [ACC Accident Compensation](#)
40
41 [Corporation](#) scheme. The remainder may have had less time off work or been ineligible for earnings-
42
43 related compensation. Not being in work at the time of interview is referred to in this paper as not
44
45 working.
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53 Data analysis

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55 Frequency tables, summary statistics and binary logistic regression analyses were used to examine the
56
57 relationship between not working and pre-injury characteristics and injury-related factors.
58
59
60

1
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3
4
5 Initially dimensional models were built using multivariable logistic regression analyses of all study
6
7
8 variables within each of the seven dimensions simultaneously entered into individual models. Age,
9
10 gender, hospital admission, body region injured, and nature of injury were included in all models as
11
12 potential confounders. Based upon participants' descriptions body region injured (lower extremities;
13
14 upper extremities; head and neck; spine and back; torso; and multiple body regions) and nature of
15
16 injury (fractures; sprains and strains; concussion; open wound/amputations; contusion/superficial;
17
18 other single injury type; and multiple injury types) were assigned using a modified version of the Barell
19
20 Matrix.²⁴ Time since injury was included as a continuous variable into all analyses to account for the
21
22 range in the timing of interviews after the injury event.
23
24
25
26
27
28
29

30 An overall multidimensional model was built by entering explanatory variables from each of the seven
31
32 dimension models showing an association of $p < 0.20$ with not working as independent variables.
33
34

35 Backward stepwise elimination (criteria $p < 0.10$) was used to select the final variables for inclusion.
36

37 Post-hoc testing of model using the Hosmer and Lemeshow goodness of fit test and area under the
38
39 curve was undertaken to assess model fit. Analyses were performed using STATA statistical package
40
41

42
43 11.1.
44
45
46
47

48 Ethics

49 Ethical approval for this study was obtained from the New Zealand Multi-Region Ethics Committee.
50
51

52 Informed consent was obtained from all participants.
53
54
55
56
57

58 RESULTS

59
60

~~Of the 2626 POIS participants who were workforce active pre injury, 11 were missing responses to the work status question at the 3 month post injury survey and were excluded from this investigation. Of the remaining 2615 workers, 720 (27%) reported not working at the time of interview (median time to interview was 3.4 months after injury; interquartile range: 2.5 to 4.1 months).~~

The mean age of participants was 41 years (SD 13 years). The majority of the cohort are male (63%), had post-secondary qualifications (60%), and were employees (85%)(see online table 1). The median annual personal income was \$45,000. Annual personal income was not provided by 16% of participants. The predominant injury type was multiple injury types (39%), followed by sprains and strains (26%) and fractures (17%). The lower (37%) and upper extremities (28%) were the most frequent body regions injured, followed by multiple injury regions (18%). Thirty percent of the cohort reported hospital admission, while a further 36% reported attending an Emergency Department (without hospital admission).

Table 2 shows the dimension-specific multivariable analyses in relation to not working three months after injury. The following pre-injury variables had p-values <0.20 in the dimension-specific logistic regression modelling:

sociodemographics (age, gender, highest qualification, income, occupation, relationship status,

adequacy of household income, financial security);

physical work (repetitive hand movements, heavy lifting, painful/tiring body positions, standing);

psychosocial (job strain, job support, job security, prior depressive episode);

work organisational (hours of work, number of days worked per week, employment contract);

lifestyle (current smoking status, BMI, exercise, sleep quantity);

health (co-morbidities, prior injury, pain or discomfort); and

injury-related (work-related injury, injury a threat to life, intent of injury, hospital admission).

In order to identify the strongest predictors of not working across all dimensions, all these variables were entered in a multivariable logistic regression analysis.

Table 2: Dimension level multivariable analyses for not working three months after injury.

| Dimension Model | Adjusted* odds ratio (95% CI) | p-value |
|--|-------------------------------|---------|
| Variable | | |
| Model 1: Pre-injury socio-demographic factors (n=2368) | | |
| Age | | |
| 18-24 | Ref | 0.05 |
| 25-34 | 0.72 (0.49 to 1.05) | |
| 35-44 | 1.12 (0.77 to 1.63) | |
| 45-54 | 1.07 (0.73 to 1.57) | |
| 55-64 | 0.94 (0.62 to 1.42) | |
| Gender | | |
| Male | Ref | 0.2 |
| Female | 0.87 (0.69 to 1.11) | |
| Highest qualification | | |
| Post secondary qualifications | Ref | 0.01 |
| Secondary qualifications | 0.98 (0.77 to 1.24) | |
| No formal qualifications | 1.44 (1.09 to 1.89) | |

| | | | |
|----|--------------------------------|---------------------|--------|
| 1 | | | |
| 2 | | | |
| 3 | Income | | |
| 4 | | | |
| 5 | ≥\$50,001 | Ref | <0.001 |
| 6 | | | |
| 7 | \$30,001-\$50,000 | 1.24 (0.95 to 1.61) | |
| 8 | | | |
| 9 | | | |
| 10 | ≤ \$30,000 | 1.81 (1.33 to 2.48) | |
| 11 | | | |
| 12 | No income given | 2.24 (1.63 to 3.07) | |
| 13 | | | |
| 14 | | | |
| 15 | Occupation | | |
| 16 | | | |
| 17 | | | |
| 18 | White collar | Ref | <0.001 |
| 19 | | | |
| 20 | Pink collar | 1.26 (0.94 to 1.68) | |
| 21 | | | |
| 22 | Blue collar | 2.15 (1.65 to 2.81) | |
| 23 | | | |
| 24 | Unclassified | 1.14 (0.59 to 2.17) | |
| 25 | | | |
| 26 | | | |
| 27 | | | |
| 28 | Relationship Status | | |
| 29 | | | |
| 30 | Married/De Facto/Civil Union | Ref | 0.1 |
| 31 | | | |
| 32 | Never married | 1.17 (0.84 to 1.62) | |
| 33 | | | |
| 34 | Separated/Divorced | 1.34 (0.92 to 1.94) | |
| 35 | | | |
| 36 | Widowed | 2.19 (0.94 to 5.12) | |
| 37 | | | |
| 38 | | | |
| 39 | | | |
| 40 | Living arrangements | | |
| 41 | | | |
| 42 | | | |
| 43 | Living alone | Ref | 0.3 |
| 44 | | | |
| 45 | Living with familial other | 1.31 (0.87 to 1.96) | |
| 46 | | | |
| 47 | Living with non-familial other | 1.37 (0.84 to 2.22) | |
| 48 | | | |
| 49 | | | |
| 50 | Adequacy of household income | | |
| 51 | | | |
| 52 | | | |
| 53 | Sufficient | Ref | 0.1 |
| 54 | | | |
| 55 | Insufficient | 1.17 (0.94 to 1.47) | |
| 56 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | Material standard of living | | |
| 4 | | | |
| 5 | High/Fairly high | Ref | 0.4 |
| 6 | | | |
| 7 | Medium | 1.08 (0.87 to 1.35) | |
| 8 | | | |
| 9 | Fairly low/Low | 0.82 (0.49 to 1.35) | |
| 10 | | | |
| 11 | Financial security | | |
| 12 | | | |
| 13 | Secure/Fairly secure | Ref | <0.001 |
| 14 | | | |
| 15 | Fairly insecure/Insecure | 1.55 (1.22 to 1.96) | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | <hr/> | | |
| 21 | Model 2: Pre-injury physical work factors (n=2509) | | |
| 22 | | | |
| 23 | Repetitive hand movements | | |
| 24 | | | |
| 25 | Never | Ref | 0.09 |
| 26 | | | |
| 27 | Occasionally/sometimes | 0.78 (0.55 to 1.13) | |
| 28 | | | |
| 29 | ¼ to ½ the time | 0.77 (0.55 to 1.06) | |
| 30 | | | |
| 31 | ¾ of time or greater | 1.03 (0.78 to 1.36) | |
| 32 | | | |
| 33 | Heavy lifting | | |
| 34 | | | |
| 35 | Never | Ref | 0.05 |
| 36 | | | |
| 37 | Occasionally/sometimes | 1.29 (0.98 to 1.72) | |
| 38 | | | |
| 39 | ¼ to ½ the time | 1.37 (0.99 to 1.89) | |
| 40 | | | |
| 41 | ¾ of time or greater | 1.66 (1.15 to 2.38) | |
| 42 | | | |
| 43 | Painful/tiring body positions | | |
| 44 | | | |
| 45 | Never | Ref | 0.001 |
| 46 | | | |
| 47 | Occasionally/sometimes | 1.17 (0.91 to 1.51) | |
| 48 | | | |
| 49 | ¼ to ½ the time | 1.96 (1.44 to 2.65) | |
| 50 | | | |
| 51 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | ¾ of time or greater | 1.61 (1.16 to 2.24) | |
| 4 | | | |
| 5 | Standing | | |
| 6 | | | |
| 7 | Never | Ref | >0.001 |
| 8 | | | |
| 9 | | | |
| 10 | Occasionally/sometimes | 1.65 (1.08 to 2.54) | |
| 11 | | | |
| 12 | ¼ to ½ the time | 1.32 (0.87 to 1.99) | |
| 13 | | | |
| 14 | ¾ of time or greater | 2.03 (1.38 to 2.96) | |
| 15 | | | |
| 16 | | | |
| 17 | Physical exertion | | |
| 18 | | | |
| 19 | | | |
| 20 | Never | Ref | 0.6 |
| 21 | | | |
| 22 | Occasionally/sometimes | 1.18 (0.88 to 1.59) | |
| 23 | | | |
| 24 | ¼ to ½ the time | 1.08 (0.78 to 1.49) | |
| 25 | | | |
| 26 | ¾ of time or greater | 1.19 (0.86 to 1.65) | |
| 27 | | | |
| 28 | | | |
| 29 | | | |
| 30 | Model 3: Pre-injury psychosocial factors (n=2362) | | |
| 31 | | | |
| 32 | Job strain | | |
| 33 | | | |
| 34 | | | |
| 35 | Low strain | Ref | >0.001 |
| 36 | | | |
| 37 | Active | 0.88 (0.66 to 1.17) | |
| 38 | | | |
| 39 | Passive | 1.37 (1.02 to 1.83) | |
| 40 | | | |
| 41 | High strain | 1.52 (1.13 to 2.02) | |
| 42 | | | |
| 43 | Job support | | |
| 44 | | | |
| 45 | Quartile 1- High | Ref | 0.03 |
| 46 | | | |
| 47 | Quartile 2 | 0.65 (0.46 to 0.94) | |
| 48 | | | |
| 49 | Quartile 3 | 0.73 (0.57 to 0.94) | |
| 50 | | | |
| 51 | Quartile 4 – Low | 0.80 (0.61 to 1.04) | |
| 52 | | | |
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| 1 | | | |
| 2 | | | |
| 3 | Job security | | |
| 4 | | | |
| 5 | Very secure | Ref | 0.03 |
| 6 | | | |
| 7 | Secure | 1.27 (1.02 to 1.59) | |
| 8 | | | |
| 9 | Insecure/very insecure | 1.46 (1.02 to 2.10) | |
| 10 | | | |
| 11 | Job satisfaction | | |
| 12 | | | |
| 13 | Completely/mostly satisfied | Ref | 0.4 |
| 14 | | | |
| 15 | Neither satisfied nor dissatisfied | 0.85 (0.61 to 1.20) | |
| 16 | | | |
| 17 | Mostly/completely dissatisfied | 0.80 (0.51 to 1.26) | |
| 18 | | | |
| 19 | Self-efficacy | | |
| 20 | | | |
| 21 | Good | Ref | 0.2 |
| 22 | | | |
| 23 | Poor | 0.80 (0.56 to 1.14) | |
| 24 | | | |
| 25 | Optimism | | |
| 26 | | | |
| 27 | Yes | Ref | 0.5 |
| 28 | | | |
| 29 | No | 1.09 (0.81 to 1.47) | |
| 30 | | | |
| 31 | Prior depressive episode | | |
| 32 | | | |
| 33 | No | Ref | 0.03 |
| 34 | | | |
| 35 | Yes | 1.27 (1.02 to 1.59) | |
| 36 | | | |

Model 4: Pre-injury work organisational factors (n=2518)

| | | | |
|----|---------------|---------------------|-------|
| 45 | Hours of work | | |
| 46 | | | |
| 47 | ≤ 30 hrs | Ref | 0.004 |
| 48 | | | |
| 49 | 31-45 hrs | 0.84 (0.63 to 1.14) | |
| 50 | | | |
| 51 | 45-65 hrs | 0.86 (0.61 to 1.22) | |
| 52 | | | |
| 53 | | | |
| 54 | | | |
| 55 | | | |
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|----|--|---------------------|--------|
| 1 | | | |
| 2 | ≥ 66 hrs | 1.32 (0.72 to 2.44) | |
| 3 | | | |
| 4 | Number of days worked per week | | |
| 5 | | | |
| 6 | | | |
| 7 | ≤ 5 days | Ref | >0.001 |
| 8 | | | |
| 9 | | | |
| 10 | 6-7 days | 1.68 (1.31 to 2.15) | |
| 11 | | | |
| 12 | Employment contract | | |
| 13 | | | |
| 14 | | | |
| 15 | Employee - permanent | Ref | >0.001 |
| 16 | | | |
| 17 | Employee - temporary/casual | 2.25 (1.58 to 3.20) | |
| 18 | | | |
| 19 | Employee - fixed term | 1.51 (0.98 to 2.35) | |
| 20 | | | |
| 21 | Employee - other contract types | 1.50 (0.76 to 2.98) | |
| 22 | | | |
| 23 | Self-employed | 1.20 (0.87 to 1.66) | |
| 24 | | | |
| 25 | Employer | 0.70 (0.44 to 1.12) | |
| 26 | | | |
| 27 | Multiple job holding | | |
| 28 | | | |
| 29 | | | |
| 30 | Yes | Ref | 0.8 |
| 31 | | | |
| 32 | No | 1.04 (0.74 to 1.45) | |
| 33 | | | |
| 34 | | | |
| 35 | | | |
| 36 | | | |
| 37 | | | |
| 38 | Model 5: Pre-injury lifestyle factors (n=2445) | | |
| 39 | | | |
| 40 | Alcohol consumption | | |
| 41 | | | |
| 42 | | | |
| 43 | Low | Ref | 0.6 |
| 44 | | | |
| 45 | High | 0.95 (0.77 to 1.18) | |
| 46 | | | |
| 47 | Current smoking status | | |
| 48 | | | |
| 49 | | | |
| 50 | No | Ref | 0.009 |
| 51 | | | |
| 52 | Yes | 0.76 (0.62 to 0.93) | |
| 53 | | | |
| 54 | | | |
| 55 | Body Mass Index | | |
| 56 | | | |
| 57 | | | |
| 58 | | | |
| 59 | | | |
| 60 | | | |

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|----|---|---------------------|--------|
| 1 | | | |
| 2 | | | |
| 3 | ≤24 | Ref | >0.001 |
| 4 | | | |
| 5 | 25-29 | 1.24 (0.99 to 1.56) | |
| 6 | | | |
| 7 | ≥30 | 1.61 (1.26 to 2.05) | |
| 8 | | | |
| 9 | | | |
| 10 | Exercise (days per week) | | |
| 11 | | | |
| 12 | 5-7 days | Ref | >0.001 |
| 13 | | | |
| 14 | ≤ 4 days | 0.63 (0.52 to 0.76) | |
| 15 | | | |
| 16 | | | |
| 17 | Sleep quantity (per week) | | |
| 18 | | | |
| 19 | 5-7 nights obtaining ≥7hrs sleep | Ref | 0.1 |
| 20 | | | |
| 21 | ≤ 4 nights obtaining ≥7hrs sleep | 0.85 (0.68 to 1.07) | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | Model 6: Pre-injury health factors (n=2426) | | |
| 26 | | | |
| 27 | Overall self-assessment for health | | |
| 28 | | | |
| 29 | | | |
| 30 | Excellent/Very Good | Ref | 0.4 |
| 31 | | | |
| 32 | Good/Fair/Poor | 0.91 (0.73 to 1.13) | |
| 33 | | | |
| 34 | | | |
| 35 | Co-morbidities | | |
| 36 | | | |
| 37 | No co-morbidities | Ref | 0.06 |
| 38 | | | |
| 39 | 1 co-morbidities | 0.82 (0.66 to 1.04) | |
| 40 | | | |
| 41 | 2 or more co-morbidities | 1.14 (0.87 to 1.48) | |
| 42 | | | |
| 43 | | | |
| 44 | | | |
| 45 | Prior injury | | |
| 46 | | | |
| 47 | No | Ref | 0.1 |
| 48 | | | |
| 49 | Yes | 0.82 (0.63 to 1.06) | |
| 50 | | | |
| 51 | | | |
| 52 | | | |
| 53 | Prior disabling condition | | |
| 54 | | | |
| 55 | No | Ref | 0.7 |
| 56 | | | |
| 57 | | | |
| 58 | | | |
| 59 | | | |
| 60 | | | |

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|----|--|----------------------|--------|
| 1 | | | |
| 2 | | | |
| 3 | Yes | 1.04 (0.77 to 1.40) | |
| 4 | | | |
| 5 | Pain or discomfort | | |
| 6 | | | |
| 7 | None | Ref | 0.1 |
| 8 | | | |
| 9 | | | |
| 10 | Moderate | 1.00 (0.70 to 1.43) | |
| 11 | | | |
| 12 | Extreme | 3.46 (0.93 to 12.78) | |
| 13 | | | |
| 14 | | | |
| 15 | Work capacity | | |
| 16 | | | |
| 17 | High (≥ 7) | Ref | 0.9 |
| 18 | | | |
| 19 | Low (< 7) | 1.01 (0.48 to 2.11) | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | Model 7: Injury-related factors (n=2509) | | |
| 24 | | | |
| 25 | Work-related injury | | |
| 26 | | | |
| 27 | No | Ref | >0.001 |
| 28 | | | |
| 29 | Yes | 1.46 (1.21 to 1.78) | |
| 30 | | | |
| 31 | | | |
| 32 | Intent of injury event | | |
| 33 | | | |
| 34 | No | Ref | 0.07 |
| 35 | | | |
| 36 | Yes – assaultive | 1.55 (0.96 to 2.50) | |
| 37 | | | |
| 38 | Injury a threat to life | | |
| 39 | | | |
| 40 | No | Ref | >0.001 |
| 41 | | | |
| 42 | Yes/Maybe | 1.94 (1.45 to 2.58) | |
| 43 | | | |
| 44 | | | |
| 45 | Injury a threat of serious disability | | |
| 46 | | | |
| 47 | No | Ref | 0.9 |
| 48 | | | |
| 49 | Yes/Maybe | 1.00 (0.82 to 1.21) | |
| 50 | | | |
| 51 | | | |
| 52 | Hospital admission | | |
| 53 | | | |
| 54 | | | |
| 55 | | | |
| 56 | | | |
| 57 | | | |
| 58 | | | |
| 59 | | | |
| 60 | | | |

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|----|---------------------------|---------------------|--------|
| 1 | | | |
| 2 | No | Ref | |
| 3 | | | |
| 4 | Yes | 1.74 (1.42 to 2.13) | >0.001 |
| 5 | | | |
| 6 | | | |
| 7 | Access to health services | | |
| 8 | | | |
| 9 | No difficulties accessing | Ref | |
| 10 | | | |
| 11 | Difficulties accessing | 0.95 (0.70 to 1.29) | 0.7 |
| 12 | | | |
| 13 | | | |
| 14 | | | |

15 *All dimension-level models were adjusted for age, gender, hospital admission, body region injured,
 16 nature of injury & time since injury.
 17

18
 19
 20
 21
 22
 23 Table 3 presents the overall multidimensional logistic regression model identifying the strongest (as
 24 defined by the variable p-value <0.10) predictors of not working 3 months after injury. Several socio-
 25 demographic factors were associated with greater odds of not working including: workers with a low
 26 personal income; those who gave no income; workers with a blue collar occupation and those
 27 reporting financial insecurity. While age was significantly associated with not working as a term, no
 28 individual age category was at significantly higher odds of not working compared to the reference of
 29 18-24 year olds. Physical work conditions associated with increased odds of not working included
 30 those working in painful/tiring, or standing positions at work. Unlike the bivariate analysis, the
 31 association between not working and repetitive hand movements was not significant in the physical
 32 work factor model, however it remains in the overall multi-dimensional model as it fits the backwards
 33 stepwise elimination criteria (p<0.10). Several work organisational factors were associated with
 34 greater odds of not working: workers with temporary/casual employment contracts compared to those
 35 with permanent contracts and workers with long-week work schedules compared to those working ≤5
 36 days.
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Table 3: Significant independent predictors of not working three months following injury. (n=2250)

| Explanatory variable | Work absent <i>n</i> =609 N | Adjusted * odds ratio | 95% CI | p-value |
|--------------------------------------|-----------------------------------|--------------------------|--------------|---------|
| Sociodemographic: Age | | | | |
| 18-24 | 95 | Ref | | 0.004 |
| 25-34 | 96 | 0.73 | 0.50 to 1.07 | |
| 35-44 | 146 | 1.23 | 0.85 to 1.78 | |
| 45-54 | 172 | 1.33 | 0.92 to 1.91 | |
| 55-64 | 100 | 1.28 | 0.86 to 1.91 | |
| Sociodemographic: Gender | | | | |
| Male | 424 | Ref | | 0.5 |
| Female | 185 | 0.93 | 0.72 to 1.20 | |
| Sociodemographic: Income | | | | |
| ≥ \$50,000 | 140 | Ref | | <0.001 |
| \$30,001-\$50,000 | 208 | 1.16 | 0.88 to 1.53 | |
| ≤ \$30,000 | 149 | 1.52 | 1.09 to 2.12 | |
| Refused to give income | 112 | 2.11 | 1.49 to 2.98 | |
| Sociodemographic: Financial security | | | | |
| Secure/Fairly secure | 436 | Ref | | 0.006 |
| Fairly insecure/Insecure | 173 | 1.41 | 1.10 to 1.80 | |
| Sociodemographic: Occupation | | | | |
| White collar | 146 | Ref | | 0.01 |

| | | | | |
|----|--|-----|------|--------------|
| 1 | | | | |
| 2 | | | | |
| 3 | Pink collar | 120 | 1.04 | 0.76 to 1.42 |
| 4 | | | | |
| 5 | Blue collar | 331 | 1.52 | 1.14 to 2.02 |
| 6 | | | | |
| 7 | Unclassified | 12 | 0.96 | 0.46 to 2.01 |
| 8 | | | | |
| 9 | | | | |
| 10 | Physical work: Painful/tiring body positions | | | |
| 11 | | | | |
| 12 | Never | 216 | Ref | <0.001 |
| 13 | | | | |
| 14 | Occasionally/sometimes | 168 | 1.33 | 1.01 to 1.74 |
| 15 | | | | |
| 16 | ¼-½ the time | 116 | 2.12 | 1.54 to 2.92 |
| 17 | | | | |
| 18 | ¾ of time or greater | 109 | 1.93 | 1.38 to 2.72 |
| 19 | | | | |
| 20 | | | | |
| 21 | | | | |
| 22 | Physical work: Standing | | | |
| 23 | | | | |
| 24 | never | 42 | Ref | <0.001 |
| 25 | | | | |
| 26 | occasionally/sometimes | 66 | 1.92 | 1.20 to 3.07 |
| 27 | | | | |
| 28 | ¼-½ the time | 91 | 1.60 | 1.03 to 2.49 |
| 29 | | | | |
| 30 | ¾ of time or greater | 410 | 2.25 | 1.51 to 3.34 |
| 31 | | | | |
| 32 | | | | |
| 33 | Physical work: Repetitive hand movements | | | |
| 34 | | | | |
| 35 | never | 104 | Ref | 0.03 |
| 36 | | | | |
| 37 | occasionally/sometimes | 71 | 0.69 | 0.46 to 1.02 |
| 38 | | | | |
| 39 | ¼-½ the time | 107 | 0.76 | 0.53 to 1.09 |
| 40 | | | | |
| 41 | ¾ of time or greater | 327 | 1.04 | 0.76 to 1.42 |
| 42 | | | | |
| 43 | | | | |
| 44 | Work organisation: Employment contract | | | |
| 45 | | | | |
| 46 | Permanent | 410 | Ref | 0.02 |
| 47 | | | | |
| 48 | Temporary | 64 | 1.89 | 1.27 to 2.81 |
| 49 | | | | |
| 50 | Fixed term | 32 | 1.43 | 0.87 to 2.33 |
| 51 | | | | |
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| 2 | | | | |
| 3 | Other or no formal contract | 12 | 1.62 | 0.73 to 3.59 |
| 4 | | | | |
| 5 | Self-employed | 62 | 1.10 | 0.76 to 1.59 |
| 6 | | | | |
| 7 | Employer | 29 | 0.82 | 0.49 to 1.36 |
| 8 | | | | |
| 9 | | | | |
| 10 | Work organisation: Number of days worked per week | | | |
| 11 | | | | |
| 12 | ≤5 days per week | 419 | Ref | <0.001 |
| 13 | | | | |
| 14 | 6-7 days per week | 190 | 1.54 | 1.21 to 1.96 |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | |
| 18 | Lifestyle: BMI | | | |
| 19 | | | | |
| 20 | Under/normal weight (≤24) | 193 | Ref | 0.01 |
| 21 | | | | |
| 22 | Over weight (25-29) | 238 | 1.18 | 0.92 to 1.51 |
| 23 | | | | |
| 24 | Obese (≥30) | 178 | 1.48 | 1.13 to 1.94 |
| 25 | | | | |
| 26 | | | | |
| 27 | | | | |
| 28 | Lifestyle: Sleep quantity (nights ≥7hrs sleep) | | | |
| 29 | | | | |
| 30 | 5-7 nights | 475 | Ref | 0.06 |
| 31 | | | | |
| 32 | ≤ 4 nights | 134 | 0.79 | 0.61 to 1.01 |
| 33 | | | | |
| 34 | | | | |
| 35 | Lifestyle: Exercise (days per week) | | | |
| 36 | | | | |
| 37 | 5-7 days | 392 | Ref | <0.001 |
| 38 | | | | |
| 39 | ≤4 days | 217 | 0.67 | 0.54 to 0.83 |
| 40 | | | | |
| 41 | | | | |
| 42 | Injury: Hospital admission | | | |
| 43 | | | | |
| 44 | No | 369 | Ref | <0.001 |
| 45 | | | | |
| 46 | Yes | 240 | 2.10 | 1.66 to 2.64 |
| 47 | | | | |
| 48 | | | | |
| 49 | Injury: Self-perceived threat to life | | | |
| 50 | | | | |
| 51 | No | 505 | Ref | <0.001 |
| 52 | | | | |
| 53 | Yes/Maybe | 104 | 1.90 | 1.38 to 2.62 |
| 54 | | | | |
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| 57 | | | | |
| 58 | *adjusted for body region injured, nature of injury, time since injury | | | |
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6 While the overall Body Mass Index term did not have a significant association with not working in the
7
8 overall model, obesity was significantly associated with increased odds of not working compared to the
9
10 reference of normal Body Mass Index. The lifestyle factors of lower pre-injury exercise frequency was
11
12 associated with reduced odds of not working. The other lifestyle factor pre-injury sleep was not
13
14 associated with working status but remains in the model as it fits the model criteria. Injury-related
15
16 factors associated with increased odds of not working that remained in the overall multi-dimensional
17
18 model were: those workers who perceived their injury was a threat to their life and those who were
19
20 admitted to hospital following their injury. None of the psychosocial or health factor variables
21
22 examined in this study remained in the overall multidimensional model. Diagnostic testing of the
23
24 overall model indicated goodness of fit was acceptable ($\chi^2=2279$, $p=0.13$) and the model had good
25
26 accuracy in correctly discriminating if a worker was absent from work (area under curve=0.76).²⁵ The
27
28 pseudo R² was 0.1533.
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37 DISCUSSION

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39 This paper presents evidence regarding pre-injury predictors of not working three months after injury.
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41 The injuries sustained by this cohort were sufficient enough to potentially warrant at least one week of
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43 entitlement compensation. The multivariable multidimensional model confirmed a set of important
44
45 pre-injury predictors of not working three months following injury. Specifically, our analysis confirmed
46
47 previous findings that certain socio-demographic, work and injury factors predict work status. This
48
49 study also broadened the focus to examine dimensions rarely examined previously and found work
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51 organisation and lifestyle factors were also important predictors of work status. Psychosocial factors
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53 were suggested in prior studies to be an important predictor of working after injury^{18 17}, however, of
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the pre-injury psychosocial variables examined in this study, none were found to be important in predicting work status. Our study simultaneously controlled for a broader range of determinants than have previously been investigated by researchers examining the association between psychosocial variables and work status, and this may offer one explanation why there was a lack of association between psychosocial factors and work status in our study. Health-related factors, rarely examined previously, were not found to be important predictors of work status. Our findings further confirm the need for future studies to examine a broader range of determinants and assess the relative importance of these for work disability.¹⁸

Our findings are consistent with many studies that demonstrate a relationship between work status and economic security,¹⁶⁻¹⁸ with low income workers most likely to be absent from work compared with high income workers. Additionally those who did not provide income for the income variable were more likely to be absent from work. Further descriptive analysis, not presented here, found these workers were most likely to be on employment contracts that result in fluctuating work patterns, suggesting these workers may find it difficult to provide an estimate of their annual personal income. Financial insecurity, a marker of future economic security, was associated with not working. While financial insecurity is a predictor of health outcomes,²⁶ there has been little examination of financial insecurity in relation to work status following injury. Financial insecurity is thought to influence mental health outcomes through anxiety generated by feelings of future economic insecurity.²⁶ This potential pathway needs further examination with regard to work status.

Occupational factors were important predictors of not working in our study. Previous studies using various occupational classification schemes or categorisations across have reported mixed findings regarding occupation.^{17 18} In our study, a blue collar occupation had a higher likelihood of not working.

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3 Our findings are consistent with previous cohort studies reporting blue collar workers as less likely to
4
5 have returned to work following injury adding further strength to the evidence for a causal
6
7 relationship.^{17 18} Physical work tasks involving painful/tiring body positions or standing were at
8
9 increased likelihood of not working. Exposure to physical work tasks or blue collar work in general are
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11 commonly associated with an increased risk of not working following injury.^{17 18} However, specific
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13 ergonomic hazards are rarely examined with regard to work status and our study identifies potentially
14
15 modifiable workplace ergonomic hazard exposures that are associated with not working.
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21 Aspects of work organisation are rarely examined in injury populations and our study found two
22
23 important groups of workers at increased likelihood of not working: temporary and long-week workers.
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26 Temporary employees have the poorest social and employment protections, working conditions and
27
28 higher risk of unemployment when compared with the permanent workforce.²⁷ Our finding that
29
30 workers with temporary employment were more likely to be not working compared to those in other
31
32 types of employment possibly reflects difficulties for employees in: retaining their jobs following injury;
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34 negotiating a modified return to work; or in obtaining new employment in a tight labour market.
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38 Studies examining long-term sickness absence report lower rates of absence for temporary employees,
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40 suggesting poor social protections are a key determinant of sickness absence-taking behaviour.^{28 29}
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44 Further examination of potential social and material pathways through which temporary employment
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46 can impinge upon the return to work process is warranted. Long-week work schedules also predicted
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48 not working. While long-week work schedules have not specifically been found to be associated with
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50 not working that we are aware of, other non-standard work schedules, such as long-day work
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52 schedules, have been reported to disrupt a full return to work following workplace injury.³⁰
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3 Our study found obese workers were more likely to not be working three months following injury.
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5 Increasingly studies are showing relationships between obesity, and illness-related work disability.³¹⁻³³
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7 However, few studies have investigated the impact of pre-injury obesity on work status following
8
9 injury.³¹ Obesity is often associated with a long list of chronic health conditions and while this
10
11 multivariable analysis examined the presence of co-morbidities, more specific examination is needed
12
13 to explain our findings.
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20 Contradictory to expectations those who had higher levels of exercise prior to injury were less likely to
21
22 have returned to work in our study. Our findings differ to those of a study demonstrating those with
23
24 moderate fitness prior to injury are more likely to have returned to work three months following a
25
26 whiplash injury.³⁴ Those workers used to getting regular exercise prior to their injury may have
27
28 experienced a substantial change in their exercise patterns as a consequence of their injury.
29
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31 Conceivably, they may have to cope with fewer exercise opportunities – with possible impacts on their
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33 ability to work. This may not be occurring to the same extent among workers already used to irregular
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35 exercise before injury.
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42 Two injury-related factors were strongly associated with increased odds of not working: workers who
43
44 perceived that their injury was a threat to their life and those whose injury resulted in hospital
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46 admission. While it might be reasonable to explain these observations by considering injury severity,
47
48 examination of hospital admission and threat to life within our cohort found the two variables were
49
50 measuring independent effects. Perceived threat to life is strongly associated with post-traumatic
51
52 stress disorder,³⁵ and post-traumatic stress disorder has been found to be strongly associated with
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54 failure to work following injury^{36,37}. Further work to examine potential pathways of effect is required.
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3 Our finding that hospital admission predicts not working three months following injury corroborates
4 previous findings in the few studies to include non-hospitalised injuries that report that intensive care
5 admission and length of hospital stay predicts work status.⁹
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11 The findings from our multidimensional analysis of a wide spectrum of injuries indicate interventions to
12 improve opportunities for working in the short-term following injury need to target a broad range
13 factors. As we have found some previously-unreported findings, these will need to be confirmed with
14 additional research. However, our findings indicate some self-reported pre-injury measures of socio-
15 demographic, workplace and lifestyle-related factors could be used to identify individuals with
16 increased odds of not working three months after injury. This paper identifies a number of pre-injury
17 factors which are potentially amenable to primary intervention, such as workplace hazard exposures,
18 obesity and physical exercise. For example, workplace physical activity interventions have been shown
19 to improve worksite outcomes, such as sick leave.³⁸ If confirmed, our findings would suggest that
20 primary workforce interventions focusing on lifestyle-related factors may contribute to a reduction in
21 rates of not working three months following injury, as well as contributing to maintaining a healthy and
22 productive workforce.
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The strengths of the study include the collection of pre-injury information, large sample size, inclusion of traditionally-conceived 'less severe' non-hospitalised injuries, and the collection and combined multivariable examination of a wide range of potential determinants of work status. Consequently we have found a number of important and previously unreported associations generating new hypotheses for further examination. There are a few limitations to our study. This study relies on self-reported survey data with baseline data collected retrospectively at the time of first interview: consequently

1
2 recall bias might occur. However, workers were specifically directed to consider their pre-injury
3
4 exposures and few of the pre-injury variables examined in this analysis are likely to be influenced by
5
6 their status at the time of interview. The exception to this are the psychosocial factors that may be
7
8 subject to recall bias. If so, this could have contributed to a lack of relationship between psychosocial
9
10 factors and not working following injury. The use of single item measures for psychological constructs,
11
12 such as job satisfaction and optimism, is a potential limitation to this study. However, parsimonious
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14 measures have been found to demonstrate good reliability and validity. Furthermore, we were
15
16 concerned to minimise participant interview burden (the interview took 60 minutes to complete).
17
18 Recall of the baseline pre-injury work status at the 3 month interview may be subject to recall bias.
19
20 However, verification of employment status with ACC claims records indicates the likelihood of this is
21
22 low with 1% of participants having a non-concordant employment status between the self-reported
23
24 and claims record data. A further limitation is the design of New Zealand's no-fault Accident
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26 Compensation Corporation ACC compensation system meaning the findings of this study are
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28 potentially not generalisable beyond no-fault compensation systems. However, the no-fault nature of
29
30 ACC is also a strength of our study. In other injury-compensation systems, where people are required
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32 to litigate to gain access to compensation following injury, incentives may exist such that people would
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34 be ill-advised to return to work prior to their legal case for compensation coming before the court.
35
36 Recruiting participants, via theThe universal no-fault nature of the Accident Compensation
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38 Corporation ACC scheme ~~also means we cannot~~ does not allow us to examine ~~compensation status~~work
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40 status outcome in relation to whether or not people were granted access to ACC. There may be
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42 injured New Zealanders, not included in our study, who did not access medical support from a health
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44 professional for their injury (a necessary requirement to become registered with ACC), or, who were
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46 not referred to ACC by a health professional. There is moderate evidence that the receipt and extent
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2 of compensation has a negative effect upon returning to work following injury in healthcare systems
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4 where only certain causes of injury receive compensation, such as those caused by a motor vehicle
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6 traffic crash or while at work.^{4 39} However, it is a strength of the study that the universal nature of this
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8 scheme allows us to examine predictors of work status in the short-term in a broader population
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11 context of injury and work than previously examined.
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17 In conclusion, this study indicates a number of pre-injury socio-demographic, occupational and lifestyle
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19 factors, as well as injury factors, were associated with not working three months after injury in a
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21 sample of New Zealand workers. This study confirms that the predictors of work status following injury
22
23 are multidimensional and that future studies need to examine a broader range of determinants for
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25 work disability. If these findings are confirmed, intervention strategies aimed at identifying workers at
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27 increased risk of not working and improving work status in the short-term following injury should
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29 address multiple dimensions of the worker and workplace.
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38 Article Summary

39 Article Focus

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41 • Previous examinations of predictors of work status following injury have focused primarily on
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43 hospitalised patients and a limited range of risk factors; this study examines multidimensional
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45 predictors of work status three months following hospitalised and non-hospitalised injuries.
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49 Key Message

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51 • While previous findings on socio-demographic and work factors were confirmed, a number of
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53 rarely-examined variables were associated with increased odds of not working including:
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3 obesity, temporary employment, long-day work schedules and financial insecurity.

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- Contrary to expectations, workers who were infrequent exercisers prior to injury were more likely to be working after injury.
 - This study identified a range of potential predictors of not working that, if causal, help identify workers at increased risk of not working three months after injury. If confirmed, intervention strategies should target these groups to reduce short-term work disability.

18 **Strengths and Limitations**

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- The strengths of the study include the collection of pre-injury information, large sample size, inclusion of non-hospitalised and hospitalised injuries, and the collection and combined multivariable examination of a wide range of potential determinants of work status. Consequently this study has generated new hypotheses for further examination.
 - This study relies on self-reported survey data with baseline data collected retrospectively at the time of first interview: consequently recall bias might occur. However, few of the pre-injury variables examined in this analysis are likely to be influenced by their status at the time of interview. The design of New Zealand's universal no-fault injury compensation system may limit the generalisability of study findings beyond similar systems. However, the universal nature of the New Zealand scheme allows the examination of predictors of work status in a broader population context of injury and work than previously examined.

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COMPETING INTERESTS

None declared

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